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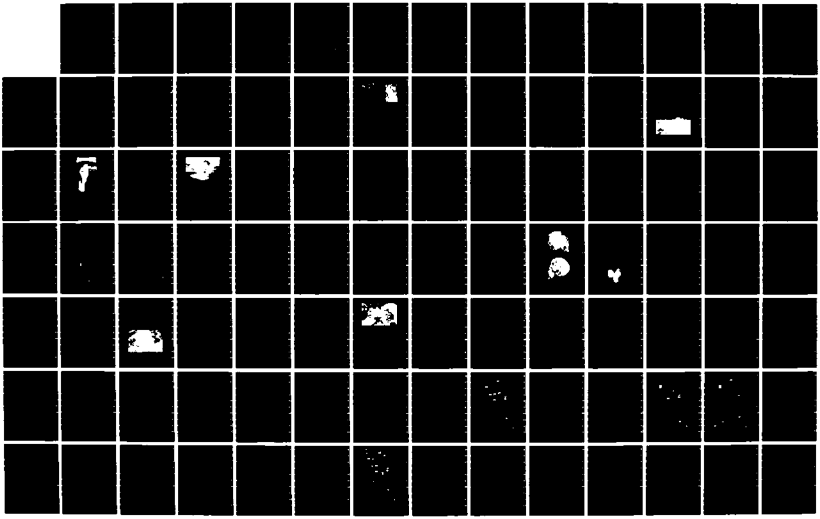

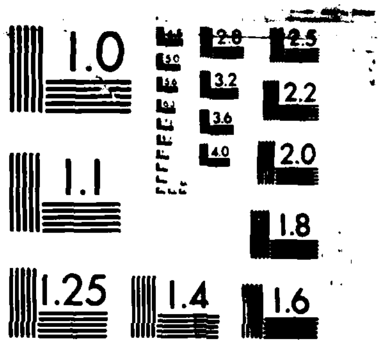

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AD-A167 574

THE Mt. GILEAD CEMETERY STUDY: AN EXAMPLE OF BIOCULTURAL ANALYSIS FROM WESTERN GEORGIA

W. DEAN WOOD

KAREN RAMEY BURNS

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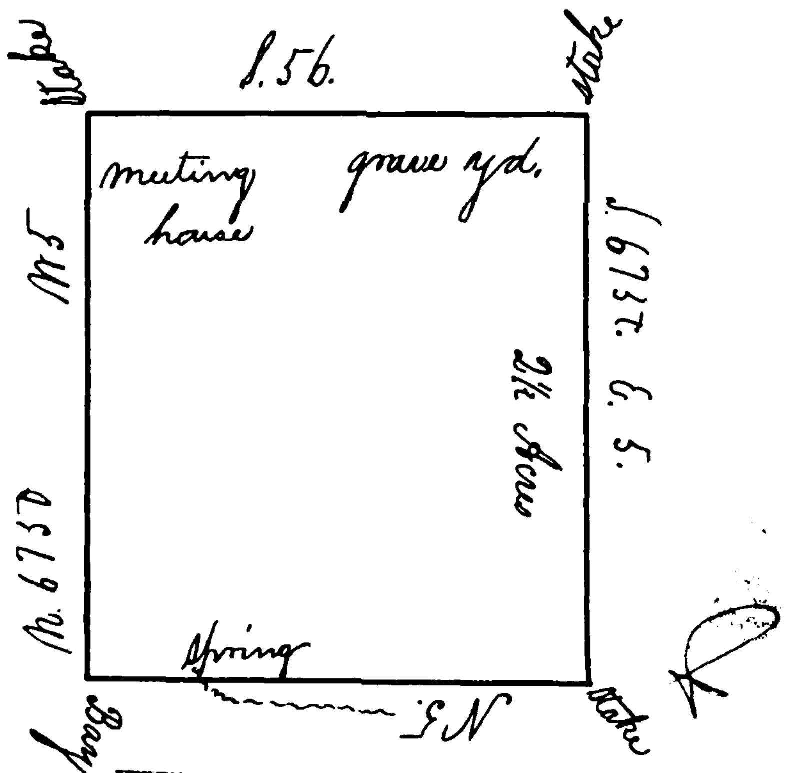

SOUTHEASTERN ARCHEOLOGICAL SERVICES, INC.

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An unmarked historic cemetery was discovered at Fort Benning, Georgia, during the construction of the Carmouche Range. Archeologists, physical anthropologists, historians, and an analytical chemist studied the cemetery and the skeletal remains in order to determine the identity of the cemetery, the identity of the people buried in it, and their health, diet, and burial customs. The results of the study suggest that the majority of individuals buried in the cemetery were white settlers who belonged to the Mt. Gilead

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Baptist Church (established 1832 and dissolved 1849). At least two blacks were buried nearby in the latter part of the nineteenth century. The study employed in-the-field osteological analysis and state-of-the-art trace element and histological aging analyses in the laboratory. One particularly interesting discovery was a very high incidence of otitis mastoidea, an ear infection, which can result in loss of hearing, loss of balance, pain, and in some cases death. Finally, the Mt. Gilead cemetery study demonstrated that the analysis of historic cemeteries by multi-disciplinary teams can provide much useful and interesting information about lifeways in the recent past.

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AN EXAMPLE OF

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WESTERN GEORGIA

Prepared for

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Principal Investigators

MAY 5 1986

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February 1986

ABSTRACT

An unmarked historic cemetery was discovered at Fort Benning, Georgia, during the construction of the Carmouche Range. Archeologists, physical anthropologists, historians, and an analytical chemist studied the cemetery and the skeletal remains in order to determine the identity of the cemetery, the identity of the people buried in it, and their health, diet, and burial customs. The results of the study suggest that the majority of individuals buried in the cemetery were white settlers who belonged to the Mt. Gilead Baptist Church (established 1832 and dissolved 1849). At least two blacks were buried nearby in the latter part of the nineteenth century. The study employed in-the-field osteological analysis and state-of-the-art trace element and histological aging analyses in the laboratory. One particularly interesting discovery was a very high incidence of otitis mastoidea, an ear infection, which can result in loss of hearing, loss of balance, pain, and in some cases death. Finally, the Mt. Gilead cemetery study demonstrated that the analysis of historic cemeteries by multi-disciplinary teams can provide much useful and interesting information about lifeways in the recent past.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the support of those individuals who contributed to the success of this project. At Fort Benning's Environmental Management Office, Mr. Tim Mullen and Mr. Carl Divinyi were the first to recognize the importance of the study and were thoroughly supportive from start to finish. The U.S. Army Corps of Engineers, West Georgia Office, at Fort Benning was also very helpful, especially Mr. Ron Sibold, Mr. Sam Barbaree, and Mr. Jeff Hill. Mr. Ed Burroughs of Fort Benning's Range Division helped arrange security and fencing to protect the cemetery. During the final fieldwork and reporting, our contract was administered by the U.S. Army Engineer District - Savannah. Key personnel from Savannah included Mr. Charles Debele, Mr. Warren Swartz, Mr. Gene Rogers, Mr. Paul Rubenstein, and Mr. Richard Anuskiewicz.

The burial relocation team from the Richardson Corporation, Owingsville, Kentucky, were indispensable. Ms. Charlotte Orme, Vice President, put her team and equipment at our disposal, assisting in the project in many ways. Thank you, Charlotte.

In Columbus, Georgia, Mr. Frank Schnell, Jr., and Mr. John Metcalf conducted the historical research. These gentlemen were instrumental in identifying the cemetery as belonging to the Mt. Gilead Baptist Church. The members of the County Line Baptist Church in rural Chattahoochee County, Georgia, graciously allowed Mr. Metcalf to transcribe and study the records of the Mt. Gilead Baptist Church. Special thanks to Mrs. Betty Gallup, who assisted Mr. Metcalf.

In Athens, Georgia, Dr. Mark Williams of the LAMAR Institute assisted with the statistical manipulation of the trace element analysis. At the University of Georgia, Dr. J.B. Jones of the Plasma Emission Spectometry Laboratory, Dr. Walter Britton of the Poultry Science Department, and Mr. Charles Murphy and Dr. Ron Ethridge of the Joint Nutrition Laboratory assisted in the preparation and running of samples for the trace element analysis.

The burial excavation crew from Southeastern Archeological Services did an excellent job under considerable time constraints. Thanks to Mr. Jerald Ledbetter, Ms. Jean Spencer, Ms. Gwyneth Duncan, Mr. Mike (Chief) Griffin, and Mr. Ron Schoettmer.

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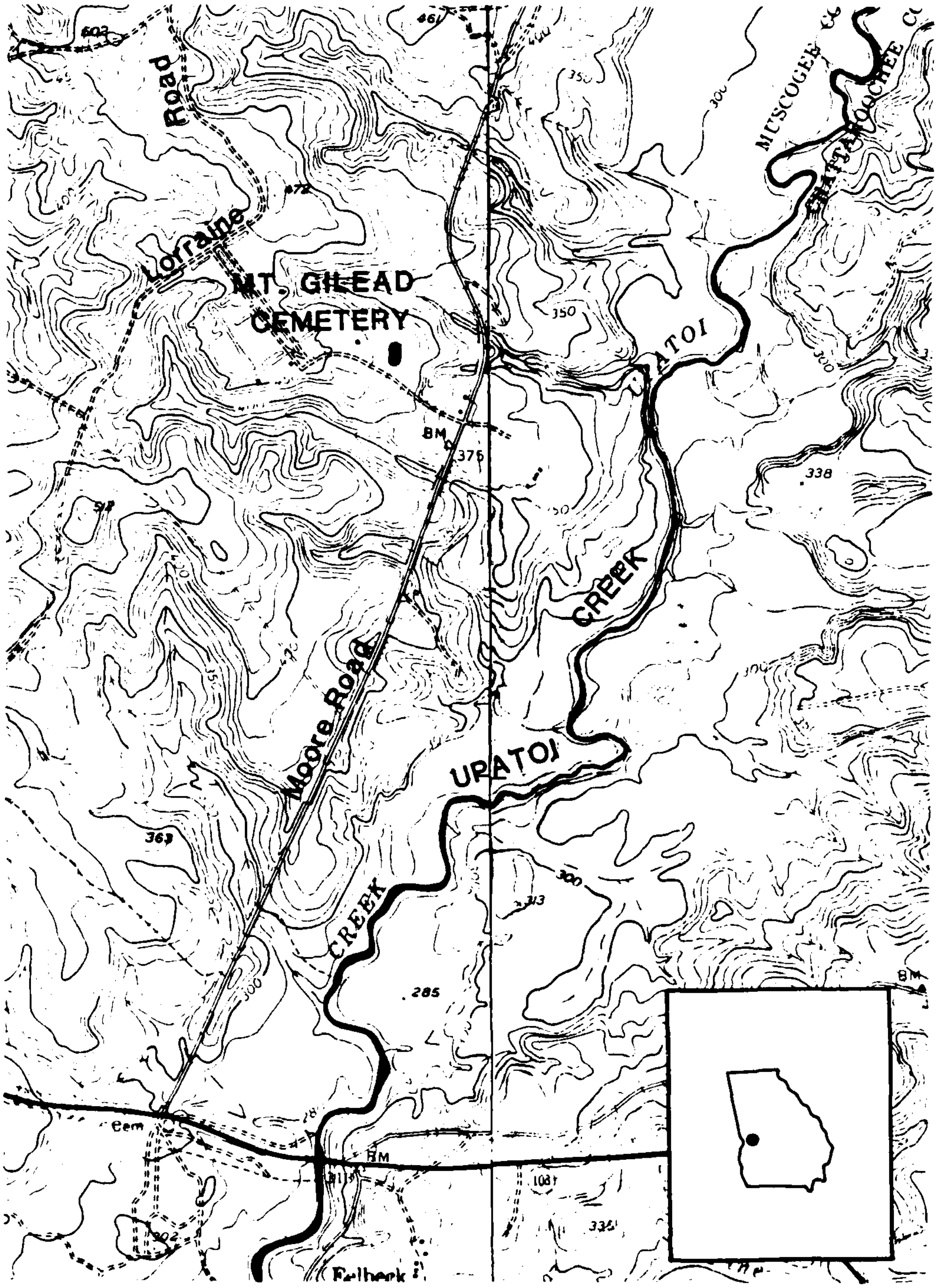
INTRODUCTION

The Project

This report presents the results of the anthropological study of the Mt. Gilead Baptist Church Cemetery at Fort Benning, Georgia (Figure 1). The cemetery was discovered during construction at Fort Benning when heavy equipment uncovered two adult human skeletons. No grave markers or tombstones were present and the cemetery's identity was unknown.

Initial investigations by Mr. Frank T. Schnell, Jr., archeologist for the Columbus Museum of Arts and Sciences, Inc., determined that the graves were not aboriginal, but historic, and probably were part of a larger cemetery. While Schnell was in the field, the construction crew uncovered the graves of two children.

Shortly afterward, a team from Southeastern Archeological Services, Inc., arrived to conduct a survey to determine the limits of the cemetery. They were able to identify the outlines of 22 more graves by controlled stripping of the sandy overburden. They also were able to examine four graves in some detail before the work was halted until a court order could be obtained. The report of the 1983 investigations erroneously concluded that the cemetery dated to the late nineteenth century and probably belonged to the Missionary Colored Baptist Church (Wood et al. 1984). The report recom-



Map Source : Ochillee 1968 and Buena Vista NW 1955, Ga. USGS 1 : 24,000

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Figure 1. Location of Mt. Gilead Cemetery.

mended that the cemetery be excavated and intensively studied by anthropologists in order to verify the identity of the cemetery and to learn about life in this section of Georgia during the nineteenth century.

These recommendations were followed and in late October, 1984, the Southeastern Archeological Services team returned to the cemetery to excavate the graves, record observations concerning the skeletons and their contexts, and take samples of bone and soil for later chemical analysis. The remains of each grave (the skeleton and cultural items) were promptly reburied by a team from the Richardson Corporation, cemetery relocation specialists.

The Personnel

The personnel who participated in the Mt. Gilead Cemetery project included specialists in archeology, physical anthropology, analytical chemistry, and history. W. Dean Wood and Chad O. Braley, of Southeastern Archeological Services, Inc., served as co-principal investigators. Wood directed the excavation of all burials, as well as the project logistics and management. Braley directed the field skeletal analysis and participated in the development of the research design. Karen R. Burns of the Center for Archaeological Sciences, University of Georgia, prepared the field analysis form, conducted field skeletal analysis, and carried out the histological aging analysis in the laboratory. Steve R. Lee, of the Western Washington Research and Extension Center in Puyallup, Washington, designed and carried out all phases of

the trace element analysis, using the facilities of the Plasma Emission Spectometry Laboratory at the University of Georgia. John Metcalf, a Columbus, Georgia, historian, traced the title of land lot 301 and reviewed the records of the Mt. Gilead and County Line Churches. Frank T. Schnell, Jr., of the Columbus Museum, traced the title for land lot 246 and reviewed the papers of Samuel D. Johnson.

RESEARCH DESIGN

Project Goals

The study of the unidentified cemetery at Fort Benning was undertaken with the following goals in mind:

1. determine the identity of the cemetery,
2. determine the identity of the individuals buried in the cemetery,
3. study the health and diet of the individuals,
4. study the burial customs of the time, and
5. demonstrate the utility for anthropological studies of historic cemeteries.

A Rationale For Historic Cemetery Studies

The current study provides an opportunity to learn much about the lifeways of the early Anglo-American residents of Western Georgia's Fall Line Hills. Traditional sources of information about the nineteenth century come from documents, which may often be biased, incomplete, or inaccurate, and therefore misleading. Even the archeological study of historic domestic sites suffers due to the lack of preservation of many items. By contrast, a human skeleton in the context of the historic grave site can yield a great deal of information about individuals and their society.

> A human burial contains more anthropological information per cubic meter of deposit than any other type of archeological feature. A burial represents the latent

images of a biological and cultural person frozen in a clearly delimited segment of space and time. [Peebles 1977:124]

With proper study, the individuals in the cemetery can be classified by age, sex, stature, and race. Careful attention to the artifacts associated with the burial can provide clues as to the temporal placement, types of clothing present, and mortuary customs. In addition, trace element analysis has recently made it possible to obtain information concerning nutrition and health: "the presence of dietary stress and its possible consequences of reduced disease resistance, retarded growth, and retarded development" can be deduced from observing differing quantities of certain trace elements in the skeleton (Gilbert 1977:85-100; see also Blakely and Beck 1982:201; Wing and Brown 1979:78-80). The demography of a cultural group can also be determined if enough individual burials can be studied.

The careful excavation and analysis of the burials from the Mt. Gilead Cemetery has contributed to the disciplines of bioarcheology and history. The information contained in the cemetery cannot be obtained from other sources; it is truly unique.

A Review of Historic Cemetery Studies

Projects involving the excavation of historic cemeteries by anthropologists are not unusual. A recent example is the Cedar Grove Historic Cemetery in southwest Arkansas (Rose 1983). This project had many parallels to the Mt. Gilead project, as it was sponsored by the U.S. Army Corps of Engi-

In Atlanta, Georgia, Drs. Roy Dickens and Robert Blakely of Georgia State University investigated the paupers' field of historic Oakland Cemetery (Dickens and Blakely 1979). The paupers' field dated from 1866 to 1884 and contained an estimated 7,575 graves, many of which were presumed to be black Americans. Three hundred and ninety-one graves were recorded, 17 were excavated, and four were intensively analyzed. The analysis included mortuary practices, forensic anthropology, demography, and trace element analysis (Blakely and Beck 1982:175-207).

In Philadelphia, archeologists were given the opportunity to excavate and study remains from an early nineteenth century black cemetery. The First African Baptist Church was founded in 1809 by freed blacks and its cemetery represents the first urban black cemetery investigated by archeologists (Parrington 1984). Studies of burial customs, health, and diet were conducted and there are plans to conduct trace element analysis on samples of the bone (Dr. Lawrence Angel, Smithsonian Institution, personal communication).

Histological Age Analysis

The Mt. Gilead Cemetery yielded 31 burials, all of which were incomplete, fragmented, and eroded by natural conditions. Many also showed the effects of coffin burial (posterior and sometimes anterior flattening of major bones). It was possible to obtain basic information on race, stature, post-adolescent sex, and pre-adolescent age by gross observation while in the field. Usually, post-adolescent (adult)

neers, New Orleans District, and the cemetery was discovered during construction along the Red River. The Cedar Grove project was a precedent-setting case that influenced the issuance of new guidelines by the National Park Service (1982:57) concerning the eligibility of cemeteries for nomination to the National Register of Historic Places (Carroll Kleinhans, New Orleans Corps of Engineers District, personal communication).

Investigators from the Arkansas Archeological Survey excavated and intensively analyzed 80 unmarked burials before the remains were reinterred. Studies of paleopathology and demography documented the poor quality of life for rural blacks in southwest Arkansas. By studying lesions on some of the bones, they were able to infer anemia, rickets, scurvy, and protein malnutrition in the population (Rose 1983:308). Other significant contributions made by the Cedar Grove project included examination of genetic admixture of the individuals, mortuary behavior, and a determination of relative economic status among individuals.

In addition to the Cedar Grove project, archeological investigations of historic, non-aboriginal cemeteries have been sponsored by the U.S. Army Corps of Engineers, Seattle District (David Munsell, personal communication) and by the Bureau of Reclamation, Tyler, Texas (Meeks Etchinson, personal communication). In Tennessee, Dr. William Bass excavated a nineteenth century German-Lutheran cemetery for the Tennessee Department of Transportation (William Bass, personal communication).

age can also be estimated by gross observation; however, the Mt. Gilead Cemetery remains were far too eroded and fragmented.

Ellis Kerley (1965, 1969, 1970) developed an aging method which is ideal for fragmented, poorly preserved bone. A thin section through the mid-shaft of a long bone is all that is required. The compact portion of the shaft of a long bone (surrounding the medullary cavity) is cortical bone. It is composed of many cylindrical Haversian systems (also called osteons). Remodeling of cortical bone produces successive, overlapping generations of Haversian systems. Fragments of osteons result from bone resorption (Tappen 1978) or from osteonal drift (Epker and Frost 1965). With increasing age, the process of resorption, rebuilding, and drift produce an ever-increasing number of osteons per unit volume of cortical bone (Currey 1964; Jowsey 1966). Figure 2 illustrates thin sections of an elderly versus a young adult to show the difference in densities of osteons. Kerley utilized observations on the dynamic nature of bone to develop an aging technique. He derived regression formulae from the analysis of 126 individuals, covering the age range from birth through 95 years. Microstructural changes in human cortical bone are measured by counting the number of osteons, osteon fragments, and non-Haversian canals and estimating the percentage of lamellar bone. A separate regression formula is applied to each count. The condition of the bone and the standard error for the formula dictate the formula(e) to use.

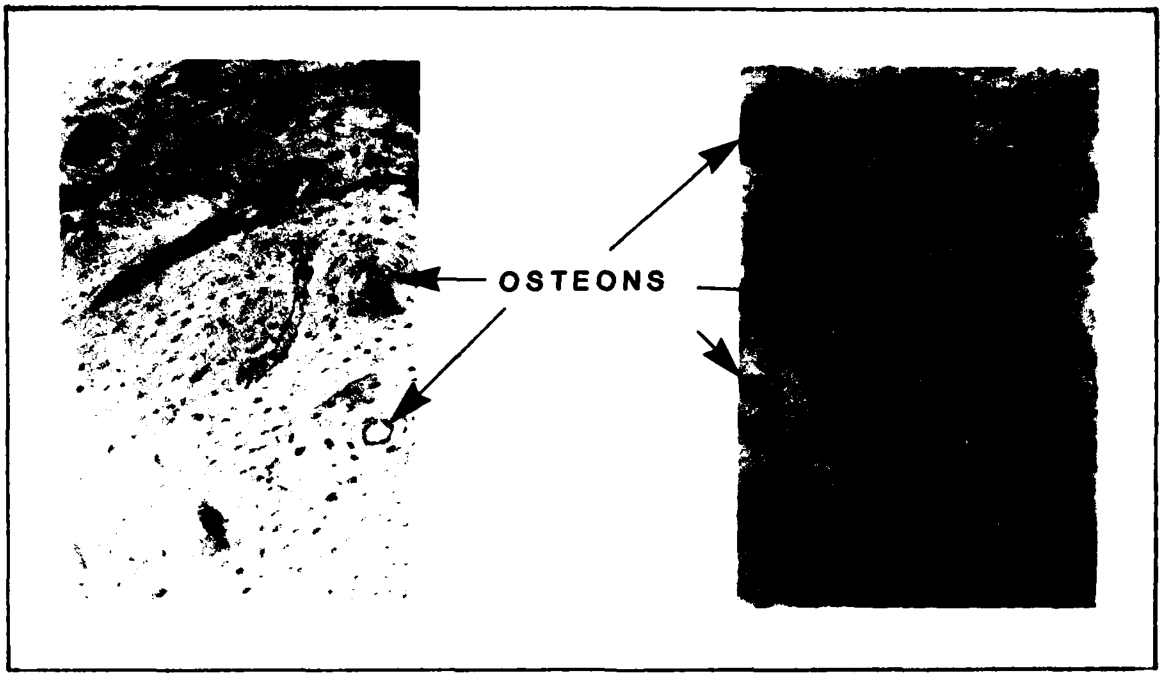

Figure 2. Two Examples of Bone Thin Sections Used in Histological Aging Analysis. (The example on the left is from a 36 year old black male; the one on the right is from an 84-year old white female.)

For this project, age estimates obtained by the use of Kerley's formulae were coupled with several other observations relating to diagenesis and pathology. This was done in order to provide information which can (1) help in the identification of the people buried in Mt. Gilead Cemetery and (2) add to the developing record of rural life in mid-nineteenth century Georgia.

Trace Element Analysis

With increasing frequency, the chemical analyses of human bone from archeological sites are providing insights into the life history of people in the past. Initial inter-

est came from the work of paleontologists. They found that Strontium (Sr) was elevated in herbivorous as opposed to carnivorous animals due to the lack of exclusion of Sr by plants; hence, Sr accumulated in the bones of herbivores due to their plant-rich diet (Toots and Voorhies 1965). When these approaches were applied to the omnivorous human, a difference was noted between the bones of hunter-gatherers and agriculturists, with the former exhibiting low Sr levels and the latter high Sr levels, presumably due to the differential grain content of their respective diets (Brown 1973, Gilbert 1975). Gilbert (1975) also noted a difference in the levels of Zinc (Zn) between those agriculturists existing on maize (which contains less zinc) versus other grains, presumably due to phytate from maize chelating the Zn and, thereby, diminishing its availability. However, this could be overcome by the ingestion of meat, a very good source of available Zn. Use of Sr as a dietary marker has been extended to look at the interaction of diet with social status (Schoeninger 1979) and with age and sex (Lambert et al. 1979).

These results, however, are somewhat confusing in light of the capacity of bone to act as an ion-exchange column, the technical difficulty of chemical analyses, and the diversity of techniques employed (Price and Kavanagh 1982; Wing and Brown 1980). For that reason, many studies concentrated on the ion exchange, or diagenesis, that occurred in human bone after burial. Lambert et al. (1979), employing atomic absorption spectrophotometry (AAS), noted that, in basic soils with burials above the water table, Sr, Zn, Magnesium (Mg),

Calcium (Ca), Sodium (Na), and Copper (Cu) appear to be unaffected in human bone by soil contamination; whereas Iron (Fe), Aluminum (Al), Manganese (Mn), and Potassium (K) were affected. Later work employing electron micro-probe analysis showed similar patterns, except Mg appeared to be affected and Lead (Pb) was unaffected by diagenesis (Lambert et al. 1983). However, Nelson and Sauer (1984) noted no diagenetic effects on levels of Zn and Mn in bone at different excavation sites. Obviously, diagenesis is a specific function of each soil pH and elemental content. It also has been shown that there is a differential rate of diagenesis for different parts of the skeleton, with that rate being greatest for trabecular bones like the rib and lowest for cortical bones like the femur (Lambert et al. 1982).

The elemental analyses of soils also vary by technique. Nelson and Sauer (1984) employed neutron activation analysis to give a total elemental profile, whereas Konrad et al. (1983) employed an acid extraction of soils to successfully delineate areas of prehistoric human activity by the relative amounts of labile soil elements.

Mt. Gilead Cemetery exhibits many differences with the sites of the aforementioned studies. First, the soils are sandy and very acid, with a greater tendency for bone dissolution, since bone is primarily calcium phosphate and basic; and there is, conversely, a greater tendency for soft tissue preservation, since acid treatment of proteins can cause a cross-linking and toughening analogous to tanning. Second, the burials are not in mounds; hence the capacity for perco-

lation of water through the bones is much greater. Third, the sample size of burials is much smaller, with a high proportion of children and individuals with an observed pathology (otitis mastoidea). Fourth, both blacks and whites were found buried there. Finally, the people under study may have been exposed to toxic heavy metals and, possibly, a different diet than aboriginal populations.

The previous studies also employed very laborious, (i.e., expensive) methodologies for bone elemental analyses. The complete dissolution of bone and/or soils employed by most of those studies, with subsequent AAS for elemental analysis (Szpunar et al. 1978) may be unnecessary. Inductively coupled argon plasma atomic emission spectrometry (ICP) is becoming more readily available at research institutes and soil testing laboratories. It is quite economical and has the capability of multi-element profiles including macro, trace, and heavy metals. With the unique characteristics of the Mt. Gilead Cemetery in mind, ICP was used for bone and extracted soil analyses in order to examine the following issues:

1. elemental diagenesis in acid vs. basic soils;
2. differences in elemental profiles in femurs with varied degrees of preservation;
3. elemental profiles of adults vs. children, males vs. females, blacks vs. whites, and persons infected with otitis mastoidea vs. those not infected.

Particular emphasis was placed on diagenesis, nutritionally important trace elements, diet reconstruction, and toxic metal exposure.

METHODS

Initial Survey

Fieldwork. The Mt. Gilead Cemetery was discovered on December 7, 1983. On December 12, a team from Southeastern Archeological Services, Inc., arrived at Fort Benning and began to carry out a scope of work which included a survey to determine the extent of the cemetery, excavation and study of the remains, possible identification of the descendants, and reburial of the individuals at a new location.

While burial 4 (left by Schnell) was being excavated, we began a search for other burials in the heavily disturbed area where burials 1 - 3 had been found. This was accomplished by an intensive search for human skeletal remains and coffin hardware. A Gradall with a toothless bucket was then employed to carefully strip the soil from the surrounding area.

The area to the north of burials 1 - 4 had been cleared of vegetation, but no significant quantities of soil had been removed. The profile between the graded area and the higher, undisturbed area was carefully examined and found to contain two grave outlines. Thinking that there would probably be more graves to the north, we decided to strip about a meter of soil off to look for additional grave stains. Two self-loading caterpillar drag pans were used to remove the disturbed topsoil in 15 cm cuts until the grave outlines were

visible (Figure 3). The grave outlines showed up as dark gray-brown stains with pronounced soil mottling and small charcoal fragment inclusions. They were easy to recognize against the lighter matrix at about 1.0 - 1.2 m below the original ground surface. At this point, the pans were dismissed and the field crew shovel-scraped the area to better define the edges of the grave outlines.

A transit was used to establish a base line through the cemetery. All graves were sequentially numbered and marked with a survey stake to the west of each outline. A plan map of the cemetery was made showing the grave outlines to scale and the orientation and relative location of each grave.

In accordance with our initial scope of work, we immediately began excavating burials. Burials 11 and 17 were

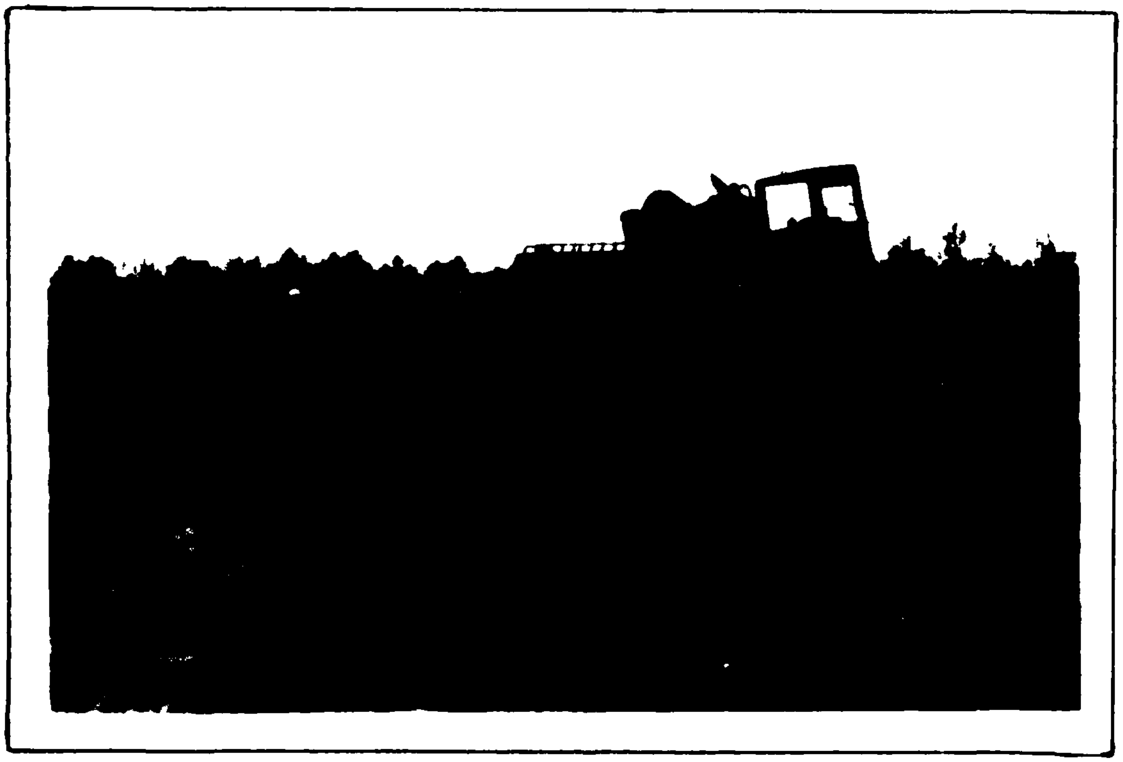

Figure 3. North End of Cemetery During Initial Survey. (View is to the northwest.)

partially excavated and 4 and 23 were completely excavated. Burials 1 - 3 were obtained from Schnell already boxed. Before excavation could proceed further, the Real Estate Division of the Savannah District Corps of Engineers stopped all work, claiming jurisdiction over historic cemeteries on U.S. Army property. The project was to be called off until the descendants could be identified and notified, and while the Army determined how the cemetery would be relocated and whether anthropologists would be involved.

After the notice to stop work was issued, all the unexcavated graves were covered with black PVC plastic and an earthen berm and fence were placed around the cemetery. Frank Schnell agreed to curate the five excavated skeletons (1 - 4 and 23) at the Columbus Museum until their disposition was determined. The Southeastern Archeological Services team returned to Athens and prepared a detailed report on the initial survey for Fort Benning officials, recommending that the cemetery be studied by archeologists, physical anthropologists, historians, and analytical chemists in an attempt to learn the identity and lifeways of the people buried there.

Informant interviews. We realized that the discoveries the week before were not isolated graves but part of a relatively small cemetery consisting of about 30 individuals. In order to learn the identity of the cemetery, the Fort Benning and Columbus, Georgia, media were alerted to the discovery. Persons having a knowledge of the cemetery were asked to contact the Environmental Management Office at Fort Benning or the Columbus Museum of Arts and Sciences, Inc. As a

result, three elderly men (two black and one white) visited the cemetery and were interviewed by the archeologists concerning their knowledge of the area in the early twentieth century. All three men had grown up in the immediate vicinity of the cemetery but had no prior knowledge of its existence.

Literature search. We asked Mr. Frank T. Schnell, Jr., archeologist at the Columbus Museum of Arts and Sciences, Inc., to conduct an exhaustive title and records search of the property. Mr. Schnell was particularly interested in this task as his great grandfather, Samuel D. Johnson, owned the property in the nineteenth century.

The location of the cemetery, as determined by the grading contractor's survey party, was at N319,000, E899,825 on the Georgia Coordinate Grid (feet). This location corresponds to the eastern edge of Muscogee County land lot 246 in district 9. Therefore, Schnell began his research on lot 246. Early on in the literature search, Schnell learned of the Mt. Gilead Baptist Church being in the vicinity; however, it was recorded as being on land lot 301 of district 10, the adjoining lot to the east of lot 246 in district 9. Shortly thereafter, Schnell discovered that, in the late nineteenth century, there existed a Missionary Colored Baptist Church recorded on land lot 245 to the south and concluded that it may have been misrecorded and may actually have been on lot 246 (Wood et al. 1984:11-12).

Final Fieldwork

On October 26, 1984, the Southeastern Archeological Services team returned to Fort Benning, this time under contract with the Savannah District Corps of Engineers to conduct a study of the cemetery. Arrangements were worked out in advance with the Army to involve archeologists and physical anthropologists in the study before the individuals in the cemetery were reburied. The archeological team worked together with a team of burial relocation experts from the Richardson Corporation of Owingsville, Kentucky. Archeologists from Southeastern Archeological Services exposed each grave by hand, using appropriate archeological techniques. Figure 4 shows a typical adult burial after exposure and before analysis. Coffin shape, size, hardware, and artifacts were recorded and each skeleton was photographed.

After each skeleton was exposed and photographed *in situ*, a physical anthropologist had an average of two hours to conduct detailed osteological analyses in the field. The skeletal remains could not be removed to a laboratory for detailed analysis by order of the U.S. Army despite our recommendations. As soon as the osteological analysis was completed, the Richardson Corporation team removed the remains, reboxed them, and reburied them in a new location off the construction site.

Standard methods in physical anthropology were used for the gross analysis of skeletal material from the cemetery. The main objective was to determine the age, sex, race, stature, and possible pathologies of each individual. The

Figure 4. Example of a Typical Adult Burial After Excavation by Archeologist and Before Analysis. (Skeleton has conformed to the shape of the hexagonal coffin. Note button on fourth lumbar vertebra.)

selection of methods was determined by the condition of the bone and limited by the amount of time allowed for examination. Because the quantity and condition of bone differed from one burial to another, there were some burials which yielded more information than others.

Adult age was estimated by the histological methods described in the previous chapter. The age of subadults was estimated by dental criteria (Schour and Massler 1941). The one infant innominate was aged according to measurements published by Fazekas and Kosa (1978).

Evaluation of the sex of each individual was based on morphological characteristics of the pelvis, skull, and femoral head. Descriptions of sexually significant traits and appropriate measurements can be found in the textbooks authored by Bass (1971), Krogman (1962), and Stewart (1979). Sexual evaluation based on the diameter of the femoral head is from the work of Pearson (1917).

Racial determination was based on cranial characteristics. In two cases, hair form provided confirmation of race. Descriptions of gross morphological differences between the races can be found in Krogman (1962) or Stewart (1979). It was anticipated that discriminate function analysis of cranial measurements would contribute to the racial determination, but all of the skulls were either crushed or warped (see Figure 5). Discriminate function analysis based on such measurements would be meaningless.

Stature estimates were based on measurements of intact long bones (Trotter and Gleser 1952). In the few cases with no clearly intact long bones, stature estimates were based on the total apex-calcaneous length of the skeleton. This measurement was taken after the skeleton was exposed and before any other disturbance took place.

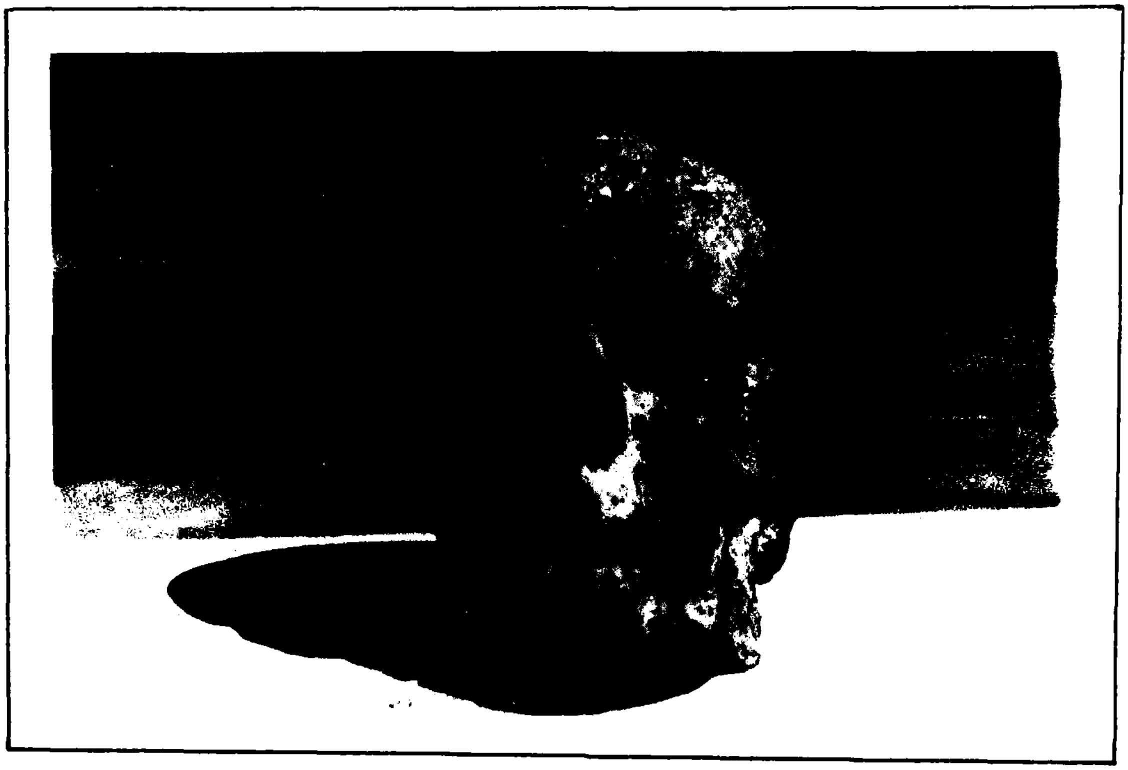

Figure 5. Example of Post-Mortem Warping and Deformation of a Cranium. (Such deformation prohibited the use of discriminate function analysis in racial determination.)

A burial field record form was developed by Karen R. Burns specifically for this project. It is reproduced in Appendix I.

To aid in the analysis of the diet and health of the people buried in the Mt. Gilead Cemetery, small samples of bone were obtained for later trace element analysis. Femur samples approximately 5 cm long were taken from the areas of thickest cortical bone from all burials where such was available. Also, soil samples from each burial were taken to study the diagenetic processes that act between human bones

and soil. In each burial, one soil sample was obtained adjacent to the femur (preserved or not), within the body stain, and the other sample was taken from the general soil matrix outside the grave fill.

Detailed photographs of certain skeletal elements which exhibited pathologies were taken (color slides and black-and-white prints). Photographs of cultural items such as coffin nails and clothing items were also taken. This photo-documentation was necessitated by the prompt reburial of all skeletal remains and artifacts.

Fieldwork was completed 30 October 1984 on schedule. The laboratory analysis of the bone and soil samples took place at Southeastern Archeological Services' laboratory and at various University of Georgia laboratories in Athens, Georgia.

Continued Historical Research

When it became apparent that the majority of the individuals buried in the cemetery were white, we quickly rejected the idea that we had found the Missionary Colored Baptist Church cemetery. Attention was then directed toward the Mt. Gilead Baptist Church, supposedly in the next land lot to the east. Apparently, the Mt. Gilead Cemetery, while officially recorded as being in land lot 301, was really in land lot 246.

Mr. John Metcalf, a historical researcher from Columbus and retired Fort Benning Forester, conducted a title search for land lot 301 of district 10. He also reviewed and tran-

scribed the records of the Mt. Gilead Baptist Church and its successor, the County Line Baptist Church.

Laboratory Analysis

Histological aging preparation. In the field, a mid-section of bone was removed from each individual with an intact femur. The bone samples were taken from the left or right femur, whichever was in better condition. The sections were 5 cm in length and were used for both chemical and microstructural analysis. In the laboratory, "thick" sections were cut, each approximately 4 mm. The thick sections were then infiltrated and embedded with epoxy resin under vacuum. The embedded thick sections were ground smooth on one side and the smooth sides were mounted on petrographic slides. The final thin sections were prepared by cutting the mounted bone sections on a diamond thin sectioning saw, equipped with a vacuum mount, and grinding them to translucency (approximately 100 micrometers) on a silicone carbide wheel. The sections were then polished and ready for microscopic viewing.

The slides were viewed with a 100X power polarizing microscope. A stage micrometer was used to calculate the correction factor between the original microscope used by Kerley in the development of this method and the one used in this analysis. Counts were taken of Haversian systems (osteons) and osteon fragments in four separate areas of each section according to the specifications in Kerley's method. Each slide of bone was viewed and counted two separate times.

The regression formulae published by Kerley and Ubelaker (1978:546) were used to calculate the age of each individual. When the disparity in age estimation exceeded the expected error, a third count was made. In two cases, new slides were prepared and reanalyzed (#23 and #8).

Trace element analysis preparation. Thin bone sections were sawed by a Stryker oscillating saw and the resulting sawdust collected. This dust was further ground with a ceramic mortar and pestle and dried at 100^{o} C overnight. Two 0.5 g replicates of the dried bone powder were then wet-ashed by a cool perchloric-nitric acid digest within acid-washed 20 ml digestion tubes in a temperature controlled mantle, by a method similar to those reviewed by Lonnerdal et al. (1983). The cool wet-ash maintained levels of volatile elements. A gentle heating ($\leq 50^{o}$ C) drove off the nitric acid. When the digestion was completed and the solutions were clear and colorless, each replicate was brought up to 20 ml in volume and 1 N in acidity with deionized water.

To quantitate the elements, four types of standards were employed. First, a solution of only the digesting acids was spiked with Zn, Sr, and Selenium (Se) such that the final volume contained, respectively, 5, 5, and 0.16 parts per million (ppm). Second, a bone sample was spiked with Zn, Sr, and Se to approximately double and quadruple expected values to check for linearity of ICP results. Third, other elements were measured against a dried milk powder standard reference material (National Bureau of Standards 1984). Fourth, the ICP was calibrated against a tissue standard prepared by the

operator. The first three standards were internal standards; that is, they were subjected to all steps of the wet-ash procedure. Additional dilution was required to measure Ca, Phosphorus (P), Na, and Mg by the ICP.

To measure soil pH, 20 g of soil were mixed and shaken with 20 ml of water and the pH read by an Orion #701 pH meter. To prepare the soil for elemental analysis the extraction method of Mehlich (1984) was employed.

All bone digests and soil filtrates were measured for elemental content by a Jarrell-Ash 9000 plasma emission spectrometer. This equipment is located at the University of Georgia's Plasma Emission Spectometry Laboratory at the Institute of Ecology.

RESULTS

The study of the Mt. Gilead Baptist Church Cemetery produced important information about the people who lived and died in the Western Georgia Sand Hills before the American Civil War. Although we were not able to link any of the unmarked graves with the names of specific individuals, we did learn a great deal about their health, physical characteristics, life expectancy, and burial customs. We also tested the feasibility of using a relatively new technique (ICP) for trace element analysis and found it to be a reliable, economical, and expedient technique. Most importantly, we demonstrated the utility of involving anthropologists in future historic cemetery identification and relocation projects.

Historical Analysis

The Mt. Gilead Baptist Church. In March of 1832, seven years after Muscogee County, Georgia, was created, a small group of settlers founded the Mt. Gilead Baptist Church. The church members were to meet one Saturday each month to conduct church business and on the following Sunday for worship (Rogers 1933:80). By the end of the first year, church membership had grown from the original 12 charter members to a total membership of 33 (Mt. Gilead Church Records). In May of 1832, the church membership appointed three commissioners to oversee the building of the meeting house.

The first reference to a property transfer comes in October 1837 when a deed and plat were recorded in the Muscogee County Courthouse. In December 1836, Jesse Cabannis transferred 2.5 ac to

> **the deacons of the babtist [sic] church at Mount Gillead [sic]...for and in consideration of the love good will and affection...for the said Church of Christ at Mount Gilliad [sic].** [Muscogee County Deed Book H:143-144]

The deed was recorded on October 27, 1837. Jesse Cabannis was not listed as a church member in the church records at this time. There were two Cabannis, Mary and George, who were received by the church in April and May 1832, but there is no indication whether Jesse was a relative.

The membership list of the Mt. Gilead Baptist Church lists 60 individuals as members during the period of 24 March 1832 through 1 December 1849. The dates received (joined) and, often, the date of dismissal are given. This information, presented in Appendix II, was transcribed by Mr. John Metcalf from the church's records, maintained by the County Line Baptist Church.

From this list, there are 29 individuals that were dismissed and were not noted as joining another church or being received again at Mt. Gilead. Whether the term `dismissed' is sometimes synonymous with `died' is not certain but it is likely that many of these church members were buried in the adjacent cemetery.

The plat that accompanies the 1837 deed is reproduced in Figure 6. It shows the location of the meeting house, a

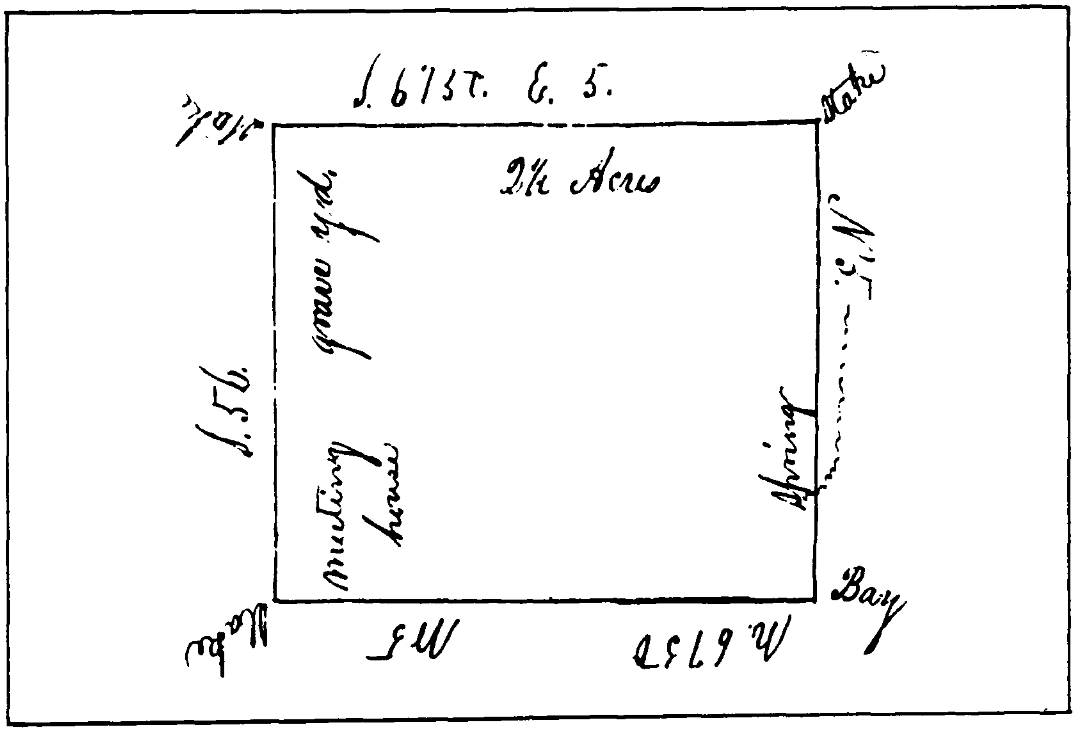

Figure 6. Plat from 1837 Deed, Showing the Mt. Gilead Baptist Church Property.

graveyard, and a spring. The meeting house appears in the southwest corner of the lot, the graveyard in the northwest corner. Both of these would have been on the high, flat ground above the slopes. East of the meeting house, a spring is depicted. This spring still flows freely from the hillside below the cemetery, forming a small stream that eventually finds its way to Upatoi Creek.

The Mt. Gilead Church existed at this location overlooking Upatoi Creek until December 1849. At that time, the members agreed in conference to "set down at this place knowed [sic] by the name of Mt. Enon in Muscogee County" (Mt. Gilead Church Records). Later, in April 1850, it was agreed

to alter the name of the church to `County Line.' Why the Mt. Gilead Church membership moved and changed its name is not known. The County Line Baptist Church exists today with an active congregation. Many of the present members are descendants of the early Mt. Gilead members.

After the initial recording of the deed in 1837, there are no other references to the Mt. Gilead Church property on lot 301. While there are references to lot 301 in other deeds, they usually refer to the northeast portion of the lot and never to the northwest corner where the church's property was located. Based on our interviews with three elderly informants, people living along nearby Moore Road in the early twentieth century had no knowledge of a church or cemetery on the hill above their homes. In 1918, the U.S. Army purchased land lot 246 in district 9 which, unknown to them, contained the Mt. Gilead Baptist Church Cemetery; and in 1941 they purchased land lot 301 in district 10.

The Missionary Colored Baptist Church. In the first attempt to identify the unknown cemetery on the Carmouche Range, references to a late nineteenth century black church located on land lot 246 or 245 of district 9 were found. A deed search by Mr. Frank T. Schnell, Jr., (Wood et al. 1984:11) turned up a deed recording the transfer of one acre of land from Samuel D. Johnson to Ellis Pope, Jackson Walker, and Seth Walker in August 1881 for the establishment of a Missionary Colored Baptist Church. The cost of the property was one dollar. The property is described as being "in the center of the south line of Lot 245" (Muscogee County Deed

Book Y n.d.:401). However, Samuel Johnson never owned lot 245, according to an intensive survey of the deed records and Johnson's will. Schnell believes that the deed was mis-recorded and that the lot intended was lot 246. The deed provided for the return of the property to Johnson if it was abandoned as a house of worship. Although the transaction took place in 1881, it was not recorded until December 1885 (Muscogee County Deed Book Y n.d.:401).

The lapse of time between the transaction and the actual recording may mean that the deed was recorded to enforce the "return to grantor" clause. If the Missionary Colored Baptist Church did not endure, one way for Samuel Johnson to reacquire title to the property would have been to officially record the transaction in order to nullify it.

There were no other references discovered concerning the Missionary Colored Baptist Church. Interviews with both black and white informants indicated no knowledge of any church or cemetery in the neighborhood in the early twentieth century. It is likely that the Missionary Colored Baptist Church did not last very long.

In summary, the deed search and the review of church records suggests that in 1832, soon after the area was opened for settlement, the Mt. Gilead Baptist Church was established. It apparently thrived during the 1830s and 1840s and then, in 1849, for reasons presently unknown, the membership elected to move 6 mi away and change its name to the County Line Baptist Church. The Mt. Gilead Baptist Church was recorded as being in lot 301 of district 10. Based on today's

precision survey techniques, we have determined that the cemetery was really about 67 ft over the property line on lot 246 of district 9. Considering the times in which the lot was deeded, property surveys were probably not extremely accurate and 67 ft may not have mattered much to the church membership. What transpired after the 1849 move is uncertain; there were no further references to the Mt. Gilead Baptist Church property changing hands. The deed search found a reference to another church in the vicinity of the project area. In 1881 there was one acre of land deeded for the establishment of a Missionary Colored Baptist Church on lot 246 or 245 in district 9. This church may not have lasted long for there was no local knowledge of a church or cemetery in the project area by the early twentieth century.

We are certain that most of the graves discovered in December 1983 were members of the Mt. Gilead Church. We are also relatively certain that the first two adults (burials 1 and 2) discovered during the grading of the hill were members of the Missionary Colored Baptist Church.

The Mt. Gilead Cemetery Layout

The original location of the Mt. Gilead Cemetery is about 13 miles due east of Columbus, Georgia. The area is situated in the Fall Line Hills of the upper Coastal Plain province (Clark and Zisa 1976). The soils in the area are very sandy and are often quite deep. Upatoi Creek is the primary tributary of the Chattahoochee River in the immediate area.

The location overlooks the Upatoi Creek Valley from atop a prominent sand hill (Figure 7). At the base of the hill to the east are several flowing springs which join small streams and find their way to Upatoi Creek. Compare the relative locations of the cemetery and spring(s) in Figure 7 with those in the 1837 plat (Figure 6). Moore Road, a nineteenth century thoroughfare, runs north-south between the cemetery and Upatoi Creek.

The Mt. Gilead Cemetery, as defined archeologically, occupied an area 150 ft long and 72 ft wide (Figure 8). This is a minimum length, as we do not know if burials 1 and 2 were at the south end of the cemetery or if others further south were removed unnoticed.

The plan of the cemetery suggests there were at least four roughly parallel rows of graves on the north end. The pattern on the south end is impossible to determine due to the prior disturbance. Comparing the high density of graves on the north end with the low density on the south end leads one to believe that many graves were removed between burials 1 and 2 and burials 5 and 13. However, this is unlikely, as the stripping in this area was conducted under the supervision of archeologist Frank T. Schnell, Jr., and an intensive search by the Southeastern Archeological Services crew revealed no disturbed human remains or coffin hardware in the area. We think it likely that the 31 graves discovered at the Mt. Gilead Cemetery represent most of the individuals originally buried there.

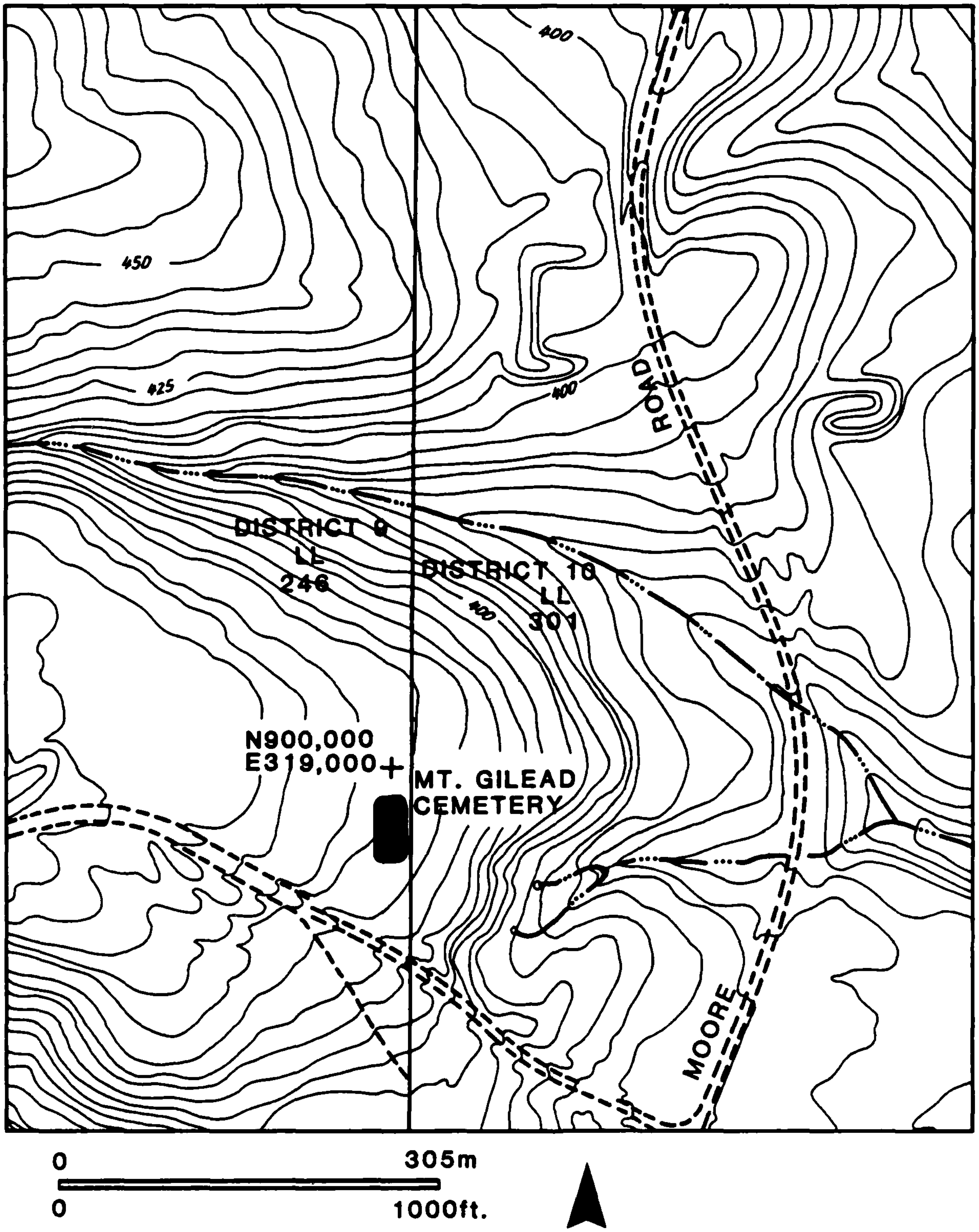

Figure 7. Topographic Map of the Mt. Gilead Cemetery Environs. (Map source: Carmouche Range Topographic sheets Q14, R14. No date.)

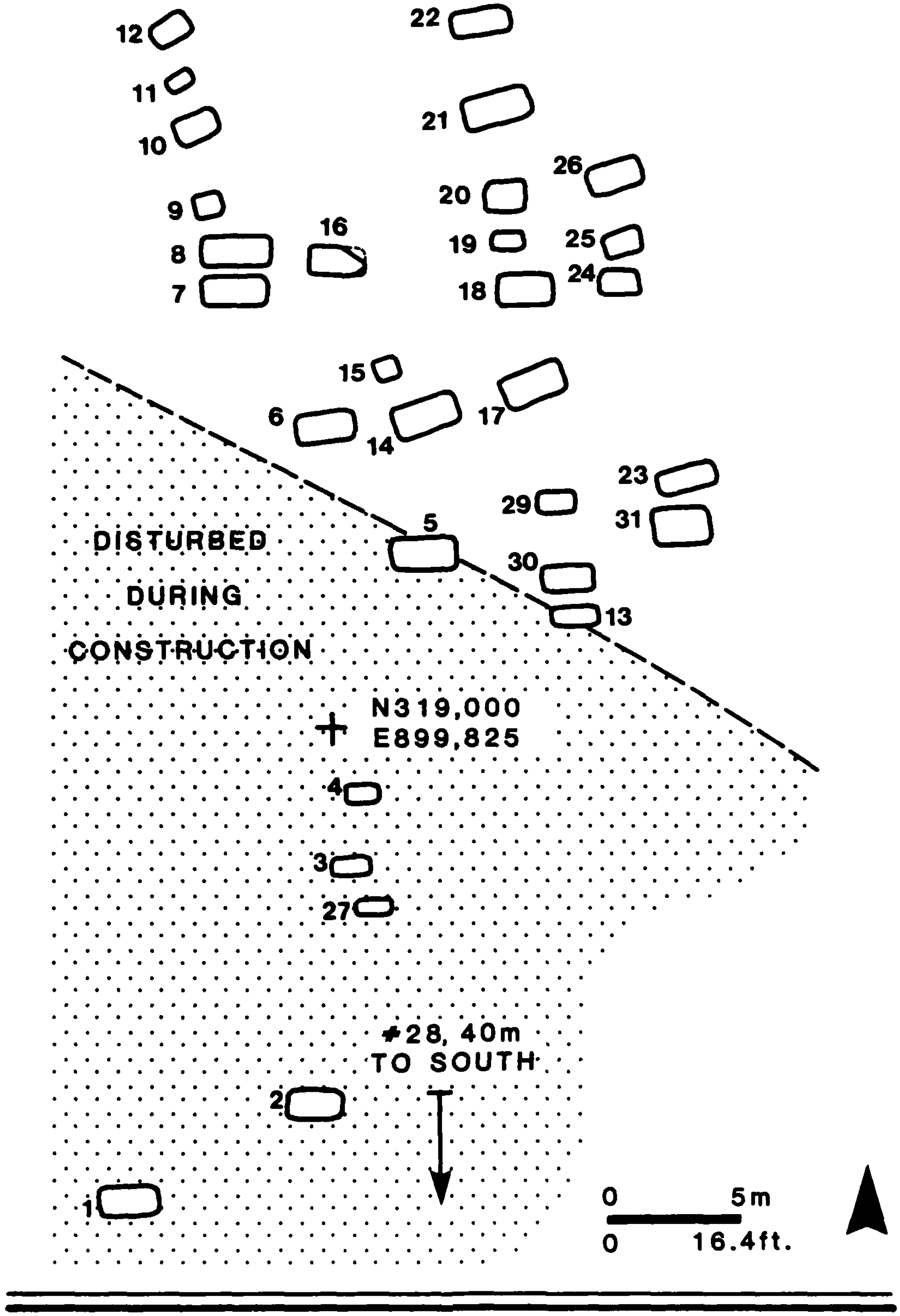

Figure 8. Plan Map of the Mt. Gilead Cemetery.

The orientation of all graves was generally east-west with the head to the west. Several of the graves are oriented more to the northeast-southwest. This alignment may reflect the season of the year or time of day when the grave was dug. Presumably, the grave was aligned with the position of the sun which, of course, varies considerably.

The depth of the graves below surface could not be determined accurately because of the severe ground disturbance from clearing and grading prior to the discovery. All burials were estimated to have occurred between 4 and 6 ft below the surface. Generally, children were buried a little shallower than adults, but this was not always the case.

The People

The following is a description of all 31 burials discovered. Burials 1 and 2 were black individuals and probably belonged to the Missionary Colored Baptist Church of the late nineteenth century. This is based on their location away from the others and the better bone preservation they exhibited. Burials 3-31 were probably all members of the Mt. Gilead Cemetery. A general description of age, sex, race, and stature is followed by an accounting of traits unique to each individual, such as pathology and dentition. In dental descriptions, the Universal Numbering System is used. Number 1 is the right maxillary third molar. The numbers move consecutively around the upper arch and then return on the lower arch to #32, the right mandibular third molar. With deci-

duous (baby) teeth, the letters A-T are used in the same manner.

Evidence of clothing and coffin shape, size, and construction are next presented. Each burial is described to the limits of the data. Where information is not included in the description, it was simply not available, given the condition of the specific burial. Table 1 summarizes all of the pertinent data observed in the field concerning all burials.

Burial 1. This was an adult male, probably black. He was estimated to be in his 30s (36 ± 9.19), based on bone histology, and was approximately 5'7" tall. The vertebrae exhibited moderate osteoarthritic lipping, a trait which commonly begins in the fourth decade of life and is exacerbated by hard labor. In conjunction with the osteoarthritis, fusion of the fifth lumbar vertebra (L5) with the sacrum was noted.

The condition of dentition was relatively good. One tooth, #19, was lost long before death. The teeth distal to #19 had drifted forward. Five teeth were lost post-mortem, #7-9; #17 and #26 and the mesial root of #17 remained in place. Three posterior teeth exhibited small carious lesions focused on the occlusal surfaces. A disto-occlusal lesion existed on #4, and #12 had a severe carious lesion. No significant alveolar resorption was apparent.

This burial was the first accidentally discovered by the grading contractor and, therefore, we have minimal information available concerning coffin style or clothing. Archeo-

Table 1. Burial Data Summary.

	BIOLOGICAL					CULTURAL	COFFIN			
Burial #	Sex	Age	Race	Pathology	Stature	Clothing Items	Shape	Length	Width	Hardware
1	M	36 ± 9.2	B	OAL	5 '7"	no data	no data	no data	no data	no data
2	M	30.5 ± 9.2	B	no	?	no data	no data	no data	no data	no data
3	?	6 (D)	?	no	?	no data	no data	no data	no data	no data
4	?	3 (D)	?	no	?	pin, 5 buttons	hex	33.1"	8.3"	cut nails
5	F	83.9 ± 9.2	W	OAL	5'4"	none	hex	68.5"	20.1"	cut nails, tacks
6	M?	47.6 ± 9.2	W	OM	5'7"	none	hex	75.6"	19.3	cut nails
7	M	61.4 ± 9.2	W?	OAL,T1	5'7"	none	rect	73.6"	19.7	cut nails
8	M	73.5 ± 9.2	W	OM	5'10"	button	hex	68.9"	19.7	cut nails, screws
9	?	0	?	no	?	2 pins	?	28.0"	11.8"	cut nails
10	?	1.5-2.0 (D)	?	no	?	shoe leather	hex	40.2"	10.6"	cut nails, screws
11	?	0.5 (D)	?	no	?	none	hex	19.7"	5.9"	cut nails, screws
12	?	2-3 (D)	?	no	?	none	hex	36.2"	11.8"	cut nails, screws
13	?	7 (D)	?	OM	3'9"	2 pins	hex	52.0"	17.0"	cut nails
14	F	43.4 ± 9.2	W	no	5'2"	none	hex	66.1"	15.7"	cut nails
15	?	0	?	no	?	pin	hex	22.0	8.3"	cut nails
16	?	7-8 (D)	?	no	4'0"	pin, 3 buttons	hex	52.8"	17.7"	cut nails
17	F	<21	W	no	5'5"	pin	rect	77.6"	23.6"	cut nails, screws, tacks, upholstry
18	?	11 (D)	?	OM	?	none	rect	64.6"	17.7"	cut nails

Table 1 cont'd

	BIOLOGICAL					CULTURAL	COFFIN			
Burial #	Sex	Age	Race	Pathology	Stature	Clothing Items	Shape	Length	Width	Hardware
19	?	0.5 (D)	?	no	2'4"	pin	rect	35.0"	12.6"	cut nails
20	?	4 (D)	?	no	?	2 pins	rect	42.1"	16.1"	cut nails
21	M	31.9 ± 9.2	W	OM, OAL	5'4"	pin, 13 buttons	hex	66.9"	15.7"	cut nails
22	?	0	?	no	?	none	rect	14.6"	6.3"	screws
23	M	70.1 ± 9.2	W	OAB	5'11"	none	hex	78.7"	21.7"	cut nails
24	?	1-1.5 (D)	?	no	?	2 pins	rect	39.0"	16.5"	cut nails
25	?	5-6 (D)	?	no	?	none	rect	41.3"	15.4"	cut nails
26	?	2 (D)	?	no	?	2 pins	hex, w/handles	47.2"	14.6"	cut nails
27	no data					no data				no data
28	no data					no data				no data
29	?	5-6 (D)	?	OM,T2	3'4"	pin	?	?	?	cut nails
30	?	11 (D)	B	no	4'4"	no	hex	63.0"	14.2"	cut nails
31	F	67.4 ± 9.2	W	OM,OP	5'3"	shoe nails	hex	74.8"	25.2"	cut nails, tacks

SEX

M=male
F=female
?=undetermined

AGE

0=newborn or stillborn
X ± 9.2=determined by histology
X (D)=determined by dentition
?=undetermined

RACE

B=black
W=white
?=undetermined

PATHOLOGY

OM=otitis mastoidea
OAL=osteoarthritic lipping
OAB=osteoarthritic bridging
OP=osteoperiostitis
T1=trauma, fracture
T2=trauma, gunshot
no=none observed

logist Frank Schnell noted that a few nails were observed around the grave "but there was no evidence of commercial coffin hardware" (Wood et al. 1984:29). Schnell also noted an iron buckle fragment lying to the immediate right of the grave.

Burial 2. This individual was an adult, probably a male and possibly black. The age at death was estimated by histological means to be 30.5 $\pm$ 9.19. No stature estimate could be obtained. We have no data concerning coffin style or clothing, as this burial was badly disturbed upon discovery.

Burial 3. This burial held a child, judged to be about six years old by dental evidence. The only observable unusual trait was an unfused metopic suture. As with burials 1 and 2, we have no data on coffin style or clothing.

Burial 4. This was a child about 3 years old (based on dental evidence) and buried in a hexagonal coffin. Clothing articles consisted of five porcelain or milk glass buttons found in the neck region and a single straight pin in the abdominal region.

Burial 5. This elderly, adult female was probably white. Histological evidence indicates she was 83.9 $\pm$ 9.19 years old. Sex was determined from both cranial and innominate features; race was determined from cranial features. She was approximately 5'4" tall. The vertebral bodies exhibited osteoarthritic lipping.

The upper incisors were lost long before death and the residual ridge was resorbed and sharp. Of the molars, the roots of #3, #19, and #32 remained; #14 was in place but was

hollowed halfway down the buccal roots by gingival caries. The remaining teeth (the lower incisors, all canines, and all but #4 premolar) were worn well into the sclerosed dentin. Residual ridge resorption was severe in the molar region and approximately 2 mm of calculus formation existed on the remaining teeth, where root exposure was 1/3 to 1/2.

There were no observed clothing articles present with burial 5. She was buried in a hexagonal coffin and the brass upholstery tacks found along the coffin stain had preserved small amounts of fabric under them due to the copper salts.

Burial 6. This was an adult of uncertain sex, probably white. This person was 47.6 $\pm$ 9.19 years old (histological evidence), and was at least 5'7" tall. The innominate appeared to be female, but the skull was more like that of a male and the femoral head measurement was in the male range. An osteolytic reaction was apparent in the mastoid processes of the temporal bones, the left being more active than the right (see Figure 9). This could be the result of otitis mastoidea, a chronic ear infection with an inflammation of the antrum and cells. The trace element analysis of this individual's bone tissue showed relatively elevated levels of copper. Over 28 ppm were present, considerably over the mean of 15.62 ppm of copper from the rest of the sampled population.

The anterior teeth were well worn into dentin and reparative dentin. The lower central incisors, #24 and #25, were lost ante-mortem. Of the posterior teeth, #1-3, #14, #16, and #31-32 were also lost ante-mortem. All edentulous areas

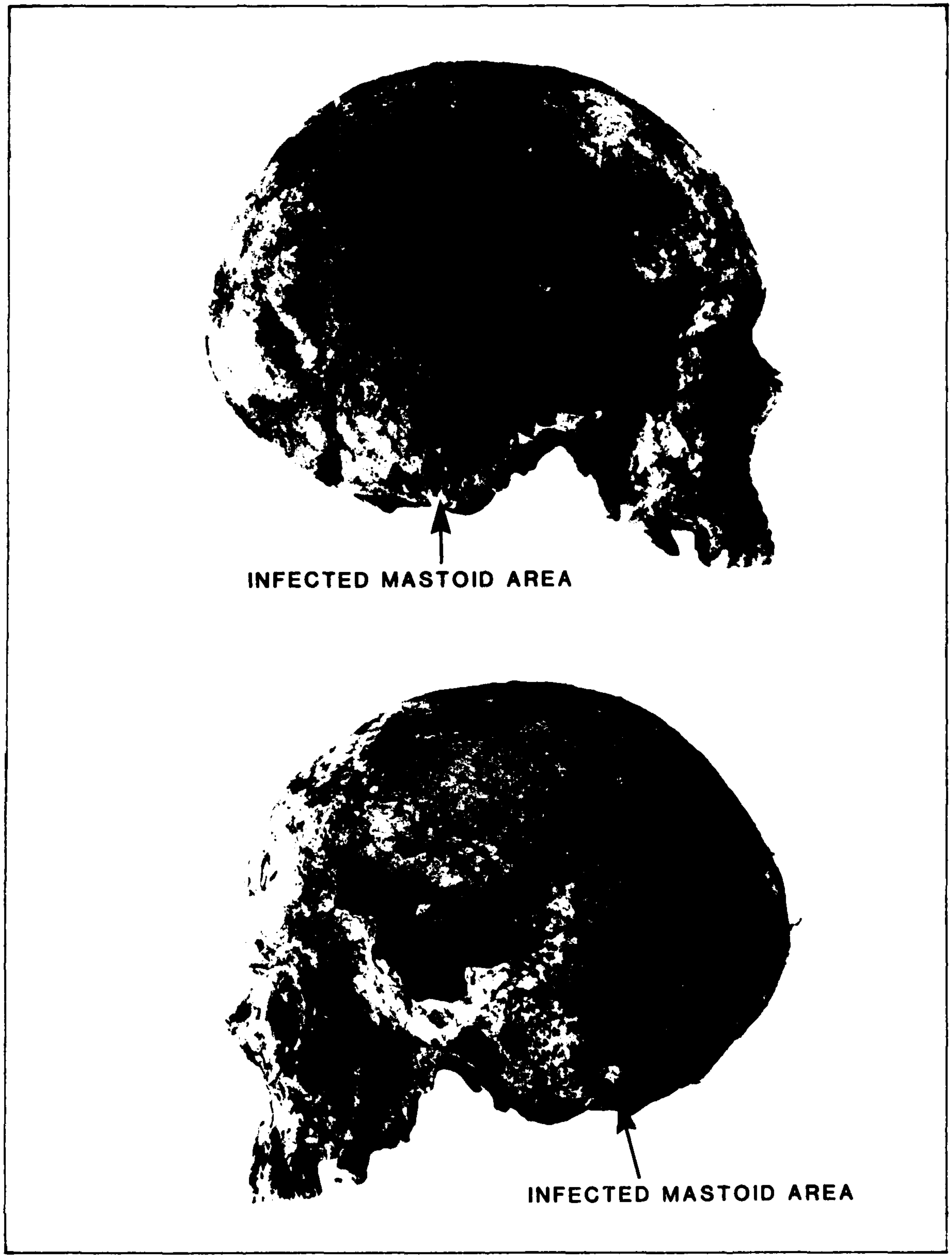

Figure 9. Examples of Bilateral Otitis Mastoidea in Burial 6.

were resorbed and rounded. A large carious lesion existed at the cementum enamel junction on the buccal surface of #17.

This person was buried in a hexagonal coffin. No clothing articles were observed.

Burial 7. This adult male was crippled by a broken left hip. He was 61.4 ± 9.19 years old (based on histological evidence) and was approximately 5'7" tall. The skull was in poor condition, but sex was determined with relative certainty from the innominate and the right femoral head. Race could not be determined by gross observation. This individual had suffered severe trauma to the left hip. The neck of the femur had been broken and the leg had not been sufficiently immobilized for a bony bridge to be established (see Figure 10). A cartilaginous joint, a pseudoarthrosis, was

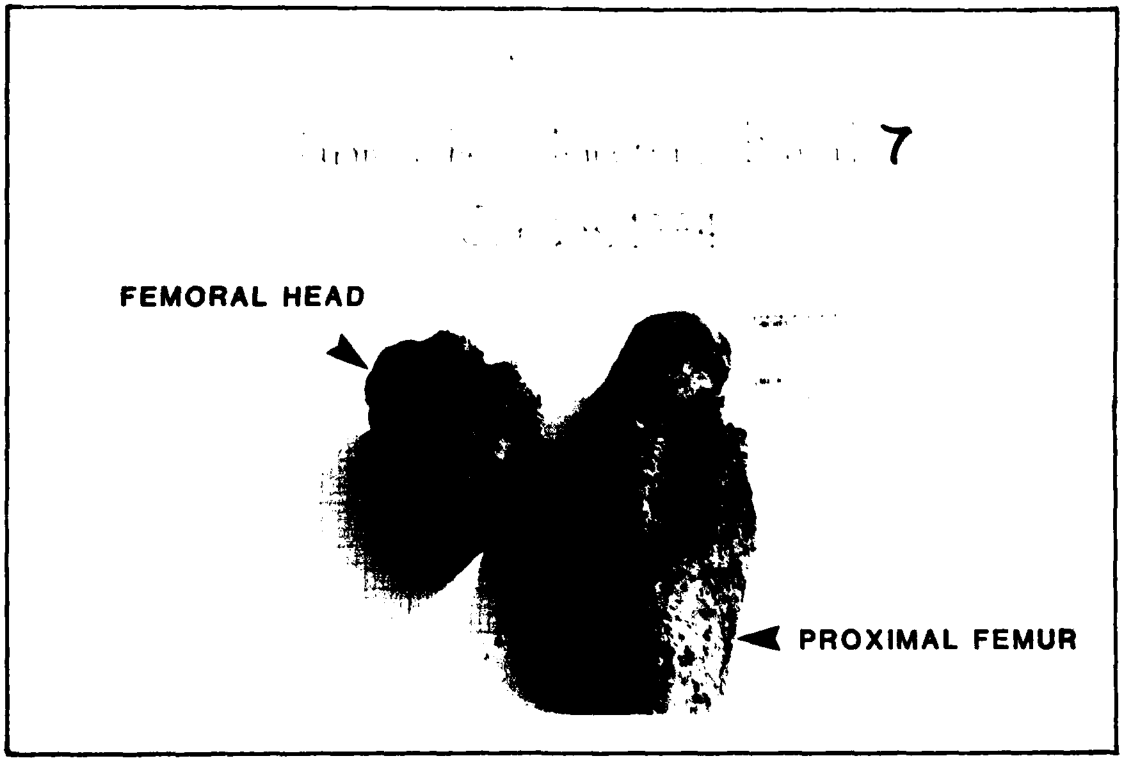

Figure 10. Broken Femoral Head and Shaft from Burial 7.

formed instead. The left femoral head and the acetabulum were extensively remodeled, and severe osteoarthritic lipping had formed on the lumbar vertebrae.

All of the incisors were present and in good condition. Of the premolars, #4 and #20 were lost ante-mortem and #13 was hollowed out by severe occlusal caries. Of the molars, only #3, #14, and #31 remained.

This person was buried in a rectangular coffin. There were no clothing articles observed.

Burial 8. This grave contained an elderly adult male, probably white. He was 73.5 ± 9.19 years old (based on histological evidence) and was approximately 5'10" tall. The left mastoid process of the temporal was pitted in much the same way as burial 6, suggesting possible otitis mastoidea.

The anterior teeth were worn into the reparative dentin (i.e., `nubs'); the only teeth not so greatly worn were the unopposed teeth, and even they were worn into the sclerosed dentin, with the exception of #30; #3 (#30's apposition) must have been lost very early in life. Teeth #1-3, #15, and #18-20 were also lost ante-mortem. Considering the age of this individual and the dental condition of the population, burial 8 had relatively healthy dentition.

This person was buried in a hexagonal coffin. A single, five-holed, bone button was found just above the pelvis, suggesting that a pair of trousers may have been worn.

Burial 9. This was an infant, possibly a newborn. The remains were fragmentary, but the left ilium was measured to

be 24.5 mm, small for a full term fetus. Either post-mortem erosion or premature birth could account for the size.

The shape of the coffin could not be determined. The infant had two brass straight pins with it, suggesting that it had been buried in a shroud or blanket.

Burial 10. This was a small child, 18-24 months old (based on dental evidence). It was buried in a hexagonal coffin and traces of shoe leather were observed at the feet.

Burial 11. This was a baby about 6 months old (based on dental evidence). It was buried in a hexagonal coffin and no clothing articles were observed.

Burial 12. This was a small child, 2-3 years old (based on dental evidence). There were no clothing articles observed. He or she was buried in a hexagonal coffin. Above the coffin and perpendicular to it were placed five burned planks, measuring approximately 26 in (67 cm) wide and 32 in (82 cm) long. Several of the boards had slumped deeply into the grave when the coffin collapsed long after interment. There was no evidence of in situ burning; rather, it appears the planks were placed over the coffin already charred. These planks were probably placed over the coffin to prevent the coffin from prematurely collapsing from the weight of the earth above it. Other burials may have had similar planks but since they were not charred, they were not preserved.

Burial 13. This child was approximately 7 years old (based on dental evidence), and taller than 3'9" (skeletal length). The left mastoid exhibited deep pitting and a

spongy appearance, much the same as burials 6 and 8, possibly a result of otitis mastoidea.

The newly erupting upper incisors were crowded and poorly aligned. The lower incisors erupted lingually. There was a carious lesion on the facial surface of the canine (M) and another lesion on the interproximal surfaces of the deciduous molars, S and T.

This child was placed in a hexagonal coffin and two brass straight pins were observed with the body.

Burial 14. This was an adult female, white. She was 43.4 $\pm$ 9.19 years old (based on histological evidence), and was approximately 5'2" tall. A well preserved hair bun was discovered high on her head. The hair was brown and straight, but may have been darker during life as hair color can change after burial.

The four upper incisors were lost post-mortem and were not recovered. Molars #14 and #30 had been extracted near the time of death. Alveolar ridge resorption was irregular and incomplete. Molar #31 appeared to have been extracted long before death. The residual ridge was resorbed and well rounded. All remaining teeth were ringed by calculus deposits. There was lingual bridging of the calculus on the lower incisors.

This person was buried in a hexagonal coffin. There were no articles of clothing preserved.

Burial 15. This was an infant, possibly a newborn. Other than scattered epiphyses, only the occipital center of

ossification and the petrous portions of the temporals were recognizable.

He or she was buried in a hexagonal coffin and one brass straight pin was found within the grave.

Burial 16. This child was 7-8 years old (based on dental evidence). Stature was determined to be a little more than 4 ft tall.

The trace element analysis of this child's bone tissue showed relatively elevated levels of arsenic and iron. These high amounts, 45.66 ppm and 566.04 ppm, respectively, exceed the means of these elements from the sampled population (11.73 ppm for As and 348.87 ppm for Fe). The implications of these numbers are discussed in the trace element analysis results.

This child was buried in a hexagonal coffin. A brass straight pin and three lead buttons were found in the chest region of the child, suggesting that a coat was worn.

Burial 17. This was an adult, white female. She was approximately 5'5" tall and wore a thick, well preserved hair bun high on her head, similar to burial 14. The age of this person was estimated to be under 21. Histological analysis was not possible because of the poor condition of both femurs.

Teeth #1-#10 were crushed post-mortem and were impossible to analyze. There was a conspicuous lack of wear on #14 and #15. There was no tooth in apposition to #14 and apposition to #15 was carious on the occlusal surface. A carious pit was all that remained of #16. Teeth #17, #19,

and #30 were lost ante-mortem. Occlusal caries were also present on #32. The lower incisors, #23-#26, were in very poor alignment.

This individual was buried in a rectangular coffin. Fragments of wood and fabric were preserved beneath and adjacent to numerous brass upholstery tacks outlining the coffin. One brass straight pin was the only clothing article found within the grave.

Burial 18. This child was approximately 11 years old, based on both dental and skeletal evidence. This individual had pitted mastoid processes and appeared to have suffered bilateral otitis mastoidea. All deciduous teeth had been shed, but the maxillary second molars were still erupting at the time of death.

This person was buried in a rectangular coffin. No clothing articles were observed.

Burial 19. This was an infant, about 6 months old. The deciduous dentition was well-formed, but had not erupted. The skeletal length was greater than 24.4 in.

This baby was buried in a rectangular coffin. A brass straight pin was the only clothing article observed.

Burial 20. This was a child about 4 years old, based on dental evidence.

He or she was buried in a rectangular coffin and two brass straight pins were discovered in the grave.

Burial 21. This was an adult, white male. He was 31.9 $\pm$ 9.19 years old (based on histological evidence) and was about 5'4" tall. The right mastoid process exhibited

pathology similar to that of burials 6, 8, 13, and 18. The tip of the right mastoid had resorbed during life. A large, well rounded pit, typical of a chronic abscess, occupied the base of the process (see Figure 11). Some osteoarthritic lipping was apparent on the vertebrae.

Teeth #3, #7, #12, #4-#18, #31, and #32 were lost antemortem. The buccal root was retained in both #3 and #14. Socket #3 had the appearance of an infectious process (dry socket). Both #5 and #6 were broken off at the cervical junction. A carious lesion covered the cervical border on the buccal surface of both #1 and #2. There was another lesion on the occlusal surface of #19.

Figure 11. Right Mastoid Process of Burial 21. (This was one of the most pronounced examples of otitis mastoidea.)

The trace element analysis of this man's bone tissue showed extremely elevated levels of copper (Cu), more than any other individual. Over 159 ppm of Cu was found in the bone, which greatly exceeds the sampled population mean of 15.62 ppm. The biological implications of this high Cu level will be discussed later in the trace element analysis results.

This individual was buried in a hexagonal coffin. He was also buried with a coat and perhaps trousers, as evidenced in the 13 buttons and one brass straight pin found in his grave. Two brass buttons were discovered on his right hip, three buttons (one bone, one lead, and one brass) were found on the upper chest region; the brass straight pin was also found on the chest. Eight other buttons (one bone and seven brass) were found after the skeleton was removed and the remaining grave fill was screened. The bone buttons both had five holes. The brass buttons represented at least four varieties, with the following inscriptions: **IMPERIAL STANDARD, DOUBLE GILT, ...M TANLEY LONDON**, and a plain type covered with fabric.

Burial 22. This was an infant, perhaps premature or stillborn. Only the supraorbital portion of a frontal bone, the petrous portion of a temporal bone, and the proximal end of the diaphysis of a femur were found.

This infant was buried in a rectangular coffin and there were no clothing articles observed.

Burial 23. This was an elderly adult male, white. He was 70.1 $\pm$ 9.19 years old (based on histological evidence)

and was approximately 5'11" (taller than the average in this population). He may not have appeared so tall in later life because his vertebrae had become compressed and remodeled by osteoarthritis. Two lumbar vertebrae (L3 and L4) were fused by osteoarthritic bridging. This individual was toothless, with the exception of a single retained root at #11.

This person was buried in a hexagonal coffin and there were no clothing articles observed.

Burial 24. This infant was 14-20 months old (based on dental evidence). The metopic suture had not yet fused. He or she was buried in a rectangular coffin and two brass straight pins were found with the body.

Burial 25. This was a child, 5-6 years old (based on dental evidence). The deciduous dentition was complete and showed wear. The first permanent molars were beginning to erupt and the lower central incisors were close to exfoliation and replacement.

This child was buried in a rectangular coffin and there were no clothing articles observed.

Burial 26. This was a child, near 2 years of age (based on dental evidence). The deciduous dentition was complete with the exception of the second molars, which were very close to erupting.

This child was buried in a hexagonal coffin with evidence of large, unusual, wooden handles. When first encountered, the coffin was large (14.6 in wide by 47.2 in long) with rounded corners. At the level of the skeleton, it became much narrower, more hexagonal in shape, and exhibited

large, fan-like extensions on each end. These were interpreted as handles, but their real function was unclear. Two brass straight pins were found, one near the thorax and one from the area of the feet.

Burials 27 and 28. Neither of these were excavated burials. Both were found south of the excavated burials in the area where burials 1-4 were discovered. Burial 27 was a badly weathered and disturbed cluster of bone fragments located close to burials 3 and 4. The remains probably belonged to a child or infant, although this could not be determined with certainty. Burial 28 was represented by a single clavicle located about 60 m (180 ft) south of the cemetery. It was probably transported to the area accidentally during the grading operations.

Burial 29. This was a child, 5-6 years old (based on dental and skeletal evidence). The deciduous dentition was complete and the first permanent molars were beginning to erupt. The central incisors were malaligned (Figure 12) and similar to those of nearby burial 13. It is possible that the two individuals were siblings. The skeleton was approximately 40 in long, an acceptable size for the age. A chronic infection appeared to have affected the mastoid processes of the temporal bones as in otitis mastoidea, the left more severely affected than the right.

This child probably died from a gunshot wound. Two shotgun pellets were found in direct association with the body. One was next to the left femur and the other was in

Figure 12. Malaligned Central Incisors of Burial 29.

the left shoulder region. Both pellets measured 4.95 mm in diameter.

The coffin outline could not be determined for this burial. One brass straight pin was the only article of clothing found.

Burial 30. This was a child, about 11 years old (based on dental evidence), possibly black. Only the maxillary second premolars were unerupted. The child was at least 4'4" tall (skeletal measurement).

The child was buried in a hexagonal coffin and there were no clothing articles observed.

Burial 31. This was an adult female, white. She was 67.4 ± 9.19 years old (based on histological evidence) and

was approximately 5'3" tall. There were pits about 2-3 mm in diameter covering the occipital and posterior parietals, consistent with porotic hyperostosis as described by Angel (1966). This condition is viewed as a stress marker. It may indicate an episode of anemia within the period prior to death. A radiograph would have been very useful in order to provide a more definitive diagnosis.

Large resorption pits occupied the mastoid processes, giving the appearance of otitis mastoidea. Evidence of pathology was more severe on the right mastoid than on the left.

Very little was left of this individual's dentition. In the maxilla, #5, #6, and #13 were in place and there were open sockets at #4, #7 and #8. Sockets were in the process of healing at #3 and #14. In the mandibular arch, #22 was in place and #17, #21, and #22 were open sockets. There was a healing socket at #32. Calculus formation was extensive on the remaining teeth and at the edge of open sockets. The residual ridges were irregular and pitted.

This person was buried in a hexagonal coffin. Brass shoe nails were present at the feet suggesting that shoes were worn.

Histological Aging Analysis

An accurate age determination could not be made in the field on ten adults, as the bones were too eroded and fragmented. The histological analysis, however, was able to provide age estimates for these individuals. The results are summarized in Table 2. They are arranged case by case in

Table 2. Results of the Histological Aging Analysis.

#	Age	Sex/Race	CE	IB	MT	POR	OZ
1	36.0	m / b	no	lam	0.44	no	single
2	30.5	m?/ b?	no	lam	0.59	no	single
5	83.9	f / w	mod	frag	0.57	var	double
6	47.6	m?/ w	mod	frag	0.55	yes	single
7	61.4	m / w?	mod	frag	0.68	yes	single
8	73.5	m / w	yes	frag	0.57	yes	single
14	43.4	f / w	mod	lam	0.46	no	single
21	31.9	m / w	mod	lam	0.62	yes	single
23	70.1	m / w	mod	frag	0.51	var	single
31	67.4	f / w	yes	frag	0.70	yes	single

(Key on following page)

Key to Table 2

#: This is the BURIAL NUMBER assigned by Southeastern Archeological Services.

AGE: The AGE ESTIMATE was obtained by the application of Kerley's femoral osteon regression formula. Femoral osteons provided the most consistent results from one application to the next for the same individual. The estimated error is 9.19 years.

SEX/RACE: Both were determined from gross observation at the time of disinterment. (male, female/black, white)

CE: CIRCUMFERENTIAL EROSION is the flaking and splintering which occurs on the bone's surface as a result of destruction of bone collagen. Soil conditions are the main contributing factor. If the individual was young at the time of death, the outermost layer was largely lamellar bone. An overly high age estimate could result if the outermost layer were completely lost in a young individual. An effort was made to compensate for this factor by taking osteon counts only in segments where the bone circumference was reasonably intact. Erosion, nevertheless, does compromise the method. (yes, no, or moderate)

IB: INTERSTITIAL BONE is the bone lying between Haversian systems (osteons). In a young individual, the interstitial bone is composed of lamellae which follow the direction of the bone circumference. In older individuals, the interstitial bone is composed of the fragments of old osteons, since remodeled. (lamellar or fragments)

MT: METABOLIC THINNING is an expression of bone thickness resulting from enlargement of the medullary canal and loss of bone mass. Erosion of the endosteal surface is a normal process in old age. It usually begins earlier in females than in males. Thinning is expressed here as a RATIO of the greatest inner diameter to the greatest outer diameter. The larger the number, the thinner the bone. (e.g., Burial #1, a 36 year old male, has a 0.44 ratio, whereas burial #31, a 67 year old female, has a 0.70 ratio)

POR: POROSITY is a highly variable trait in both cause and expression. Porous bone can be the result of age, pathology or diagenetic changes. Resorptive canals begin to form in females as early as age 40. In males, resorptive canals usually do not occur until after age 60. Paget's disease, osteomalacia (rickets), and hyperparathyroidism all mimic normal age changes (Kerley 1965). Diagenetic changes are caused by acid soil, water, fungi, root hairs, and many other stimuli common in the burial environment (Stout 1979). (yes, no or variable)

OZ: OSTEON ZONES are described by Stout (1979:234-237). Within single osteons, abrupt changes in density sometimes occur. These look like a concentric ring around the Haversian canal. (These are not to be confused with the lamellar rings containing osteocytes.) Changes in density within osteons are comparable to Harris lines and are thought to present a record of growth disturbances. Such disturbances may be either nutrition or disease related.

numerical order. Case number, estimated age, sex, and race are listed first. The structure and microstructure of the bone samples is then further described. This added information should make it possible to go a step beyond a strict formula-produced age estimate by considering the modifying influences of both pre- and post-mortem differences between individuals.

Trace Element Analysis

Bone samples from 19 preserved femurs and their complementary soil samples were analyzed for elemental composition with a relatively new technology (ICP). The results were successful in that we obtained reliable and interesting readings that contribute substantially to our understanding of the health and diet of the people buried in the Mt. Gilead Cemetery. We also better understand the diagenetic processes between human bone and the soil in which it is buried.

The following 22 elements (of a 38 element profile) were analyzed intensively. These selected elements are thought to be the most important to studies of human health and diet.

Calcium (Ca)
Phosphorus (P)
Magnesium (Mg)
Sodium (Na)
Iron (Fe)
Aluminum (Al)
Potassium (K)
Zinc (Zn)
Manganese (Mn)
Molybdenum (Mo)
Cobalt (Co)
Chromium (Cr)
Copper (Cu)
Nickel (Ni)
Selenium (Se)
Arsenic (As)

Strontium (Sr)	Cadmium (Cd)
Silicon (Si)	Lead (Pb)
Barium (Ba)	Tin (Sn)

The bone and soil elemental profiles, with a soil pH for each individual burial, are shown in Appendix III. The missing soil data is due to the fact that soil context was destroyed during the initial discovery of three burials.

The range and mean elemental composition of 19 femurs studied from the Mt. Gilead Cemetery are shown in Table 3. Table 4 contains the comparison of elemental composition of soils taken from inside and outside the burial pit and provides some insight into the problems of diagenesis. Further observations on diagenesis are provided by those data on elemental profiles as a function of the state of bone preservation presented in Table 5. Table 6 is a comparison of adults versus children; Table 7 is a comparison of males versus females; Table 8 is a comparison of blacks versus whites; and Table 9 is a comparison of individuals afflicted with otitis mastoidea versus those not afflicted.

Discussion

Appendix III and Table 3 provide data which validates the use of ICP for bone analyses. Very good agreement between tabulations of human bone content (Iyengar et al. 1978; Underwood 1977) and the data presented here occurs with only a few notable exceptions. Bone K, Na, and Pb are lower in Table 3 than in reports by Iyengar's and Lambert's (1979,

Table 3. Mean[1] Elemental Composition of All Bone Samples.

Element(ppm)	Mean	S.E.M.	Range
Ca[2]	28.14	0.90	15.55-34.52
P[2]	13.62	0.40	7.66-16.69
Mg	1185.98	161.04	397-3020
Na	3010.88	202.66	1441-3788
Fe	348.87	43.91	70-725
Al	633.81	164.98	84-3230
K	30.20	6.73	0-84
Zn	255.70	24.65	142-534
Sr	103.17	9.60	55-188
Si	62.90	15.78	0-205
Ba	43.12	8.43	11-143
Mn	57.57	18.62	5-316
Mo	3.03	1.02	1-21
Co	2.97	0.47	1-11
Cr	7.60	0.37	4-12
Cu	15.62	8.17	2-159
Ni	2.60	0.29	2-7
Se	28.79	0.81	16-36
As	11.73	2.14	4-46
Cd	0.70	0.10	0.3-2.4
Pb	30.90	1.43	22-42
Sn	7.89	3.50	3-27

[1]N=19.
[2]Ca and P in %.

1982, 1983) studies, while As is higher. Iyengar's data represent mainly biopsies of living individuals, hence no diagenesis could have occurred to reduce Na; and K probably comes from contamination of bone biopsies with other tissues like marrow or blood. The individuals at Mt. Gilead were settlers in the first half of the nineteenth century and, therefore, were probably not afflicted by lead poisoning, as this was a disease of the more affluent (i.e., pewter or lead utensils or lead solder in plumbing). These individuals also predate heavy Pb challenges such as exhaust from internal combustion engines using leaded fuel. Since Pb is not thought to be readily affected by soil diagenesis (Lambert et

al. 1983), the intermediate levels correspond well with their expected lifetime exposure. The relative time frame of their lives is, however, very close to that of the heavy use of arsenicals as pesticides in agriculture.

The levels of As in bone and soil are very appropriate for the discussions of Tables 4 and 5, which address soil profiles and bone profiles as a function of preservation and, therefore, diagenesis. Soil As levels were approximately equal inside and outside the burial, yet As levels in bone increase as bone quality deteriorates. This would imply a high affinity of bone for As and a diagenetic influx of As into bone. However, in Appendix III it is observed that burial #16 has extremely high As and Fe levels. This may be interpreted as diagenetic influx or as arsenic poisoning, since an increase in red blood cells and hemoglobin, symptomatic of arsenic poisoning, would elevate Fe as well. Also, Fe (Table 4) is much higher in the body-stained, inside soil samples than in the outside controls.

From Tables 4 and 5 one can note clear effluxes from bone of Ca, P, Mg, and Na and clear influxes of Fe, K (from the body stain), As, Al, Mn, Sn, and Si. Slight effluxes of Cu and Pb also appear, possibly due to the extremely acid soils, but Cu is compounded with disease status, as will be discussed later. Strontium (Sr), likewise, appears to decrease slightly but also may be confounded by race, sex, and age. Zinc (Zn) appears very stable but, since these are historical peoples, they may have been bombarded with Zn from galvanized utensils throughout their lives and diet recon-

Table 4. A Comparison of Labile Elemental Composition of Soil Samples from Inside and Outside the Burials.

Element (ppm)	IN[1] Mean	IN[1] S.E.M.	IN[1] Range	OUT[2] Mean	OUT[2] S.E.M.	OUT[2] Range
Ca	230.54	56.56	38-869	79.94	24.12	37-428
P	124.51	30.43	9-504	31.85	8.82	6-178
Mg	5.95	0.76	3-16	4.15	0.25	3-6
Na	65.77	4.74	43-126	60.24	1.52	41-72
Fe	96.93	10.25	34-180	44.03	7.18	29-149
Al	457.63	14.78	340-566	414.96	25.90	63-513
K	2.77	0.51	0-8	1.71	0.36	0-4.5
Zn	0.86	0.18	0.14-2.5	1.06	0.77	0.11-12.60
Sr	0.31	0.05	0.09-0.8	0.14	0.02	0.08-0.38
Si	49.34	6.20	19-114	95.42	5.88	30-114
Ba	4.35	0.55	2-9	2.38	0.15	1.5-3.5
Mn	2.68	0.53	0.06-7.15	3.95	0.28	0.5-7.4
Mo	0.00	0.00	0	0.00	0.00	0
Co	0.02	0.009	0-0.14	0.01	0.005	0-0.07
Cr	0.11	0.02	0.05-0.50	0.10	0.01	0.03-0.21
Cu	0.51	0.12	0.11-1.80	0.50	0.21	0-3
Ni	0.00	0.00	0	0.00	0.00	0
Se	1.13	0.09	0.74-2.27	0.91	0.03	0.69-1.16
As	4.88	0.17	3.0-6.0	4.81	0.20	3.8-7.1
Cd	0.00	0.00	0	0.00	0.00	0
Pb	2.67	1.08	0.85-19.50	1.20	0.05	0.76-1.9
Sn	0.00	0.00	0	0.00	0.00	0

[1]N=17
[2]N=16

struction would be difficult. Selenium and Pb appear to be unaffected by bone quality deterioration or diagenetic effects. The pattern, if any, for the remaining elements is unclear. All but one of the individuals with poor bone quality were children.

In Table 6, virtually all the elements involved with diagenesis are shown to be confounded, since this is a comparison of adults versus children. This notwithstanding,

Table 5. A Comparison of Mean[1] Elemental Composition of Bone Samples Exhibiting Varying Degrees of Preservation[2].

Element	3=Good Preservation			2=Fair Preservation			1=Poor Preservation		
(ppm)	Mean	S.E.M.	Range	Mean	S.E.M.	Range	Mean	S.E.M.	Range
Ca[3]	28.86	0.59	26.95-30.27	28.13	2.03	22.37-34.53	27.75	1.66	15.55-32.70
P[3]	13.80	0.28	13.08-14.39	13.53	0.99	10.87-16.69	13.56	0.80	7.66-15.89
Mg	2072.0	323.0	1263-3020	1139.0	182.0	566-1680	720.0	55.53	397-963
Na	3904.0	457.0	2935-5230	3009.0	310.0	2071-3703	2515.0	156.0	1441-2964
Fe	298.0	42.0	176-424	245.0	75.0	70-489	435.0	72.67	107-725
Al	308.0	68.80	160-538	342.0	113.0	84-716	976.0	310.0	198-3230
K	0.02	0.02	0-0.10	20.21	9.24	3.79-50.03	52.52	7.67	14.63-84.14
Zn	257.0	61.0	188-500	253.64	29.72	183-348	256.0	40.01	142-534
Sr	135.0	21.73	70.25-189	97.23	10.69	76.85-138.42	88.41	13.11	55.64-181.90
Si	12.03	6.66	0-36.28	43.32	40.38	0-205	102.04	17.89	27.90-188.59
Ba	36.18	7.76	16.38-60.86	21.11	3.60	11.09-31.58	59.21	15.75	16.66-142.61
Mn	21.94	6.73	7.17-47.29	9.46	1.68	5.34-14.90	104.0	33.37	7.17-315.76
Mo	1.70	0.08	1.41-1.84	5.82	3.86	1.83-21.24	2.20	0.22	1.28-3.76
Co	2.77	0.56	1.53-4.45	1.90	0.06	1.72-2.06	3.68	0.91	2.23-10.85
Cr	8.07	0.69	6.70-10.56	7.21	0.09	6.98-7.50	7.56	0.71	3.98-12.25
Cu	41.41	29.78	3.76-159.07	9.28	4.81	2.72-28.32	4.82	1.11	1.68-12.52
Ni	2.25	0.07	2.09-2.25	1.67	0.11	1.52-2.09	3.32	0.52	1.77-6.53
Se	29.58	0.23	28.98-30.21	28.07	0.29	27.05-28.66	28.76	1.74	16.32-35.52
As	7.45	1.10	4.37-10.47	7.96	1.30	4.96-12.14	16.20	4.00	7.1-45.66
Cd	0.63	0.07	0.48-0.82	0.55	0.01	0.51-0.59	0.82	0.20	0.31-2.37
Pb	33.83	2.05	27.91-38.71	31.15	3.50	24.29-42.37	29.13	2.04	22.08-39.88
Sn	6.10	0.11	5.69-6.38	6.51	1.01	5.29-10.53	9.65	2.52	3.50-27.41

[1]N=5 for Class 3; N=5 for Class 2; N=9 for Class 1.

[2]3=Well preserved femur, 2=fair preservation; cortical erosion and darkening observed; 1=poor preservation; fragmented, crumbly and darkened.

[3]Ca and P in %.

Table 6. A Comparison of Mean Elemental Composition of Bone Samples from Adults Versus Children.

Element (ppm)	ADULTS Mean	S.E.M.	Range	CHILDREN Mean	S.E.M.	Range
Ca[2]	28.88	0.98	22.37-34.52	27.13	1.75	15.55-32.17
P[2]	13.86	0.48	10.87-16.68	13.28	0.85	7.66-15.89
Mg	1523.0	227.0	566-3020	722.0	63.0	397-963
Na	3377.0	283.0	2072-5230	2506.0	177.0	1441-2964
Fe	257.0	40.27	70-489	475.0	68.0	202-725
Al	314.0	57.85	84-716	1074.0	334.0	355-3230
K	16.85	8.37	0-84.14	48.56	7.46	14.64-82.35
Zn	281.0	38.45	183-534	222.0	22.80	142-323
Sr	114.33	12.04	70-189	87.84	14.85	55.64-181.90
Si	29.01	18.13	0-205	109.51	18.43	27.80-188.59
Ba	27.56	4.44	11.09-60.86	64.53	16.81	19.80-142.61
Mn	14.93	3.59	5.34-47.29	116.0	35.26	9.51-316
Mo	3.61	1.76	1.41-21.24	2.24	0.25	1.28-3.76
Co	2.35	0.27	1.53-4.45	3.83	1.01	2.22-10.85
Cr	7.61	0.33	6.70-10.56	7.60	0.80	3.98-12.25
Cu	23.54	13.86	2.72-159.07	4.74	1.25	1.68-12.52
Ni	2.01	0.11	1.52-2.51	3.42	0.57	1.77-6.53
Se	29.01	0.33	27.05-30.91	28.49	1.94	16.31-35.52
As	7.65	0.73	4.37-12.14	17.33	4.38	8.50-45.66
Cd	0.59	0.03	0.48-0.82	0.85	0.23	0.31-2.37
Pb	32.47	1.78	24.29-42.37	28.73	2.27	22.08-39.88
Sn	6.28	0.44	5.29-10.53	10.10	2.81	3.50-27.40

[1]N=11 for Adults; N=8 for Children.
[2]Ca and P in %.

some interesting comparisons are apparent. First, Sr is somewhat lower in children than adults, implying more meat or possibly milk consumption. Also, Co is higher in children than in adults. Underwood (1977) states that Co does not concentrate with age. Possibly Co is carried over from mother to child during pregnancy. Milk is a very poor source of Co, so children's higher levels are confusing. Other elemental differences probably are best explained by diagenesis.

Very little difference exists in the elemental profiles of males versus females (Table 7). Females do seem more prone to diagenetic effects, possibly due to post-menopausal osteoperosis at the time of their deaths. Also, the females may have consumed more meat as shown by the lower Sr and higher Zn content of their bones.

A very pronounced difference in diet is apparent between blacks and whites in this study (Table 8). Blacks have twice the Sr content of whites in their bones. This implies a

Table 7. A Comparison of Mean Elemental Composition of Bone Samples from Males Versus Females.

Element (ppm)	MALES Mean	S.E.M.	Range	FEMALES Mean	S.E.M.	Range
Ca^2	30.33	0.89	28.13-34.53	27.13	1.65	22.37-32.70
P^2	14.52	0.48	13.08-16.69	13.06	0.80	10.87-15.81
Mg	1858.0	329.0	1001-3020	1120.0	216.0	566-1680
Na	3991.0	331.0	3187-5230	2641.0	161.0	2071-2967
Fe	245.0	36.0	108-341	271.0	83.0	70-489
Al	252.0	53.0	84-422	389.0	108.0	134-716
K	6.67	5.52	0-33.79	29.06	16.47	0.10-84.14
Zn	256.0	51.0	183-500	309.0	62.0	196-534
Sr	127.0	20.0	70-189	98.90	8.05	86.76-130.67
Si	9.10	5.88	0-36.28	52.90	38.65	0-204.74
Ba	26.99	4.50	15.78-45.93	28.23	8.82	11.09-60.86
Mn	18.62	6.11	7.17-47.29	10.49	2.45	5.34-17.76
Mo	1.75	0.08	1.41-2.04	5.84	3.85	1.84-21.24
Co	2.41	0.45	1.53-4.45	2.28	0.32	1.72-3.45
Cr	8.01	0.56	6.70-10.56	7.12	0.08	6.88-7.32
Cu	34.90	25.17	2.72-159.07	9.90	4.62	4.01-28.32
Ni	2.03	0.17	1.52-2.49	1.98	0.17	1.56-2.51
Se	29.28	0.27	28.59-30.21	28.70	0.67	27.05-30.91
As	6.99	0.83	4.37-9.40	8.45	1.27	4.96-12.14
Cd	0.61	0.34	0.48-0.82	0.57	0.02	0.51-0.61
Pb	33.55	2.04	27.48-38.71	31.18	3.22	24.29-42.37
Sn	6.73	0.77	5.69-10.53	5.74	0.20	5.28-6.37

[1]N=6 for Males; N=5 for Females.
[2]Ca and P in %.

Table 8. A Comparison of the Mean[1] Elemental Composition of Bone Samples from Blacks Versus Whites.

Element (ppm)	BLACKS Mean	BLACKS S.E.M.	BLACKS Range	WHITES Mean	WHITES S.E.M.	WHITES Range
Ca[2]	29.20	1.07	28.13-30.27	28.02	1.03	15.55-34.53
P[2]	13.73	0.66	13.08-14.39	13.60	0.50	7.66-16.69
Mg	2539.0	481.0	2058-3020	1027.0	126.0	397-2526
Na	4208.0	1021.0	3187-5230	2870.0	179.0	1442-4754
Fe	275.0	29.10	245-304	358.0	49.0	70-725
Al	204.0	45.0	160-249	684.0	181.0	84-3230
K	0	0	0	33.75	7.03	0-84.14
Zn	354.0	147.0	207-500	244.14	22.96	142.11-533.74
Sr	183.0	5.67	177-189	93.78	7.95	55.64-181.90
Si	0	0	0	70.30	16.75	0-205
Ba	28.86	0.97	27.89-29.82	44.80	9.37	11.09-142.61
Mn	34.06	12.23	20.82-47.29	60.34	20.74	5.34-316
Mo	1.56	0.15	1.41-1.71	3.20	1.13	1.28-21.24
Co	1.56	0.24	1.53-1.58	3.14	0.51	1.72-10.85
Cr	9.30	1.26	8.04-10.56	7.40	0.37	3.98-12.25
Cu	20.11	9.03	11.07-29.14	15.10	9.13	1.68-159.07
Ni	2.36	0.14	2.21-2.49	2.63	0.33	1.52-6.53
Se	30.08	0.13	29.95-30.21	28.64	0.90	16.32-35.52
As	5.04	0.67	4.37-5.72	12.51	2.32	4.96-45.66
Cd	0.62	0.15	0.48-0.77	0.71	0.11	0.31-2.37
Pb	35.50	2.71	32.79-38.21	30.36	1.53	22.08-42.37
Sn	5.95	0.26	5.69-6.22	8.12	1.39	3.50-27.40

[1]N=2 for Blacks; N=17 for Whites.
[2]Ca and P in %.

subsistence on grain instead of meat. All of the whites probably died between 1832 and 1849. These individuals were settlers in a frontier setting with a rich and diverse environment to exploit. The opportunity for meat consumption must have been enhanced through the availability of wild game. The two blacks whose bone samples were run on the ICP probably died in the late nineteenth century. Presumably these share-cropper tenants had much less meat in their diet than the white settlers.

Finally, Table 9 shows the difference in elemental profile between individuals affected by mastoiditis and those with no sign of infection. A slight trend of diminished nutritionally important elements (Fe, Mn, Co, Cr, Se, Ca, P,and Zn) is observed with decreased Sr levels as well. In the case of Sr, these decreases could be due to increased meat consumption, or they could be due to endogenous sources, i.e., a catabolism of their own body tissues due to chronic

Table 9. A Comparison of Mean Elemental Composition of Bone Samples from Individuals Afflicted with Otitis Mastoidea Versus Those Not Afflicted.

Element (ppm)	OTITIS MASTOIDEA[1] Mean	S.E.M.	Range	NONE[1] Mean	S.E.M.	Range
Ca[2]	27.50	1.76	22.37-30.12	28.44	1.10	15.55-34.53
P[2]	12.49	0.86	7.66-14.60	14.14	0.53	13.08-16.69
Mg	1200.0	231.0	566-1680	1180.0	198.0	397-3020
Na	2655.0	349.0	1442-3660	3175.0	245.0	2072-5230
Fe	279.0	99.0	70-489	381.0	48.0	107-725
Al	411.0	145.0	84-716	737.0	202.0	159-3230
K	18.89	12.0	0-50	35.43	7.76	0-84.13
Zn	211.0	39.41	142-347	276.53	29.74	159.05-533.74
Sr	92.57	11.95	55.64-138.42	108.07	11.0	60.60-188.75
Si	83.29	48.91	0-205	53.49	16.39	0-188.59
Ba	32.23	7.76	11.09-79.83	48.15	10.15	16.38-142.61
Mn	30.07	2.68	5.34-16.67	70.27	22.64	7.17-315.80
Mo	5.03	4.80	1.28-21.24	2.11	0.15	1.41-3.76
Co	2.50	0.65	1.72-4.45	3.20	0.58	1.53-10.85
Cr	6.67	0.17	3.98-7.50	8.04	0.47	4.01-12.25
Cu	49.40	30.97	1.68-159.07	7.25	1.80	2.55-29.14
Ni	1.94	0.18	1.52-2.30	2.91	0.35	1.53-6.53
Se	26.53	0.42	16.31-30.11	29.83	1.03	27.33-35.52
As	8.66	1.65	4.96-12.14	13.14	2.64	4.37-45.66
Cd	0.59	0.06	0.56-0.82	0.76	0.12	0.48-2.37
Pb	32.27	3.91	24.29-42.37	30.27	1.41	22.26-39.88
Sn	5.42	0.14	3.50-6.10	9.03	1.55	5.29-27.41

[1] for Mastoiditis; N=13 for Unaffected.
[2] & P are %.

infection. In contrast to the other elements' decrease, Cu is dramatically increased in some of the infected individuals. This is especially pronounced in burial 21, a 32 year old male whose cranium exhibited a chronic abscess of the right mastoid process. It is likely that this individual died as a result of an inner ear infection and the high Cu content reflects this infection. Underwood (1977) states that tissue Cu buildup during chronic infection is well documented. However, another possible source of Cu increases could be that a relatively large number of brass artifacts were buried with the individual. No content of infected individuals was very reliable.

In summary, trace element analysis has provided an economical and efficient approach to the analysis of archeological bone samples. It has also demonstrated that trace element analysis will prove to be a valuable tool in assessing the diet, health, and social status of our forebearers.

SUMMARY DISCUSSIONS

The cemetery discovered on the Carmouche Range at Fort Benning, Georgia, was associated with the Mt. Gilead Baptist Church, 1832-1849. It is quite likely that two black males from the Missionary Colored Baptist Church were buried next to the cemetery late in the nineteenth century. Although we know who the members of the Mt. Gilead Baptist Church were, we could not provide absolute identities of anyone buried in the cemetery. We were, however, fortunate to learn a great deal about the demography, health, diet, stature, and burial customs of the members buried there.

Demography

Race. In the Mt. Gilead Cemetery, we were able to determine the racial affiliation of 11 individuals: there were eight whites and three blacks. Two of the blacks were buried at the extreme southern end of the cemetery and the general condition of the bone indicated a much later interment than those to the north. These two individuals probably belonged to the Missionary Colored Baptist Church. The other black individual, an 11-year old, was buried among the whites, and the bone preservation suggests contemporaneity with the whites. This individual may have been the individual mentioned in the church's records as "Tom (col)" (Rogers 1933). Figure 13 illustrates the location of the blacks and whites in the cemetery.

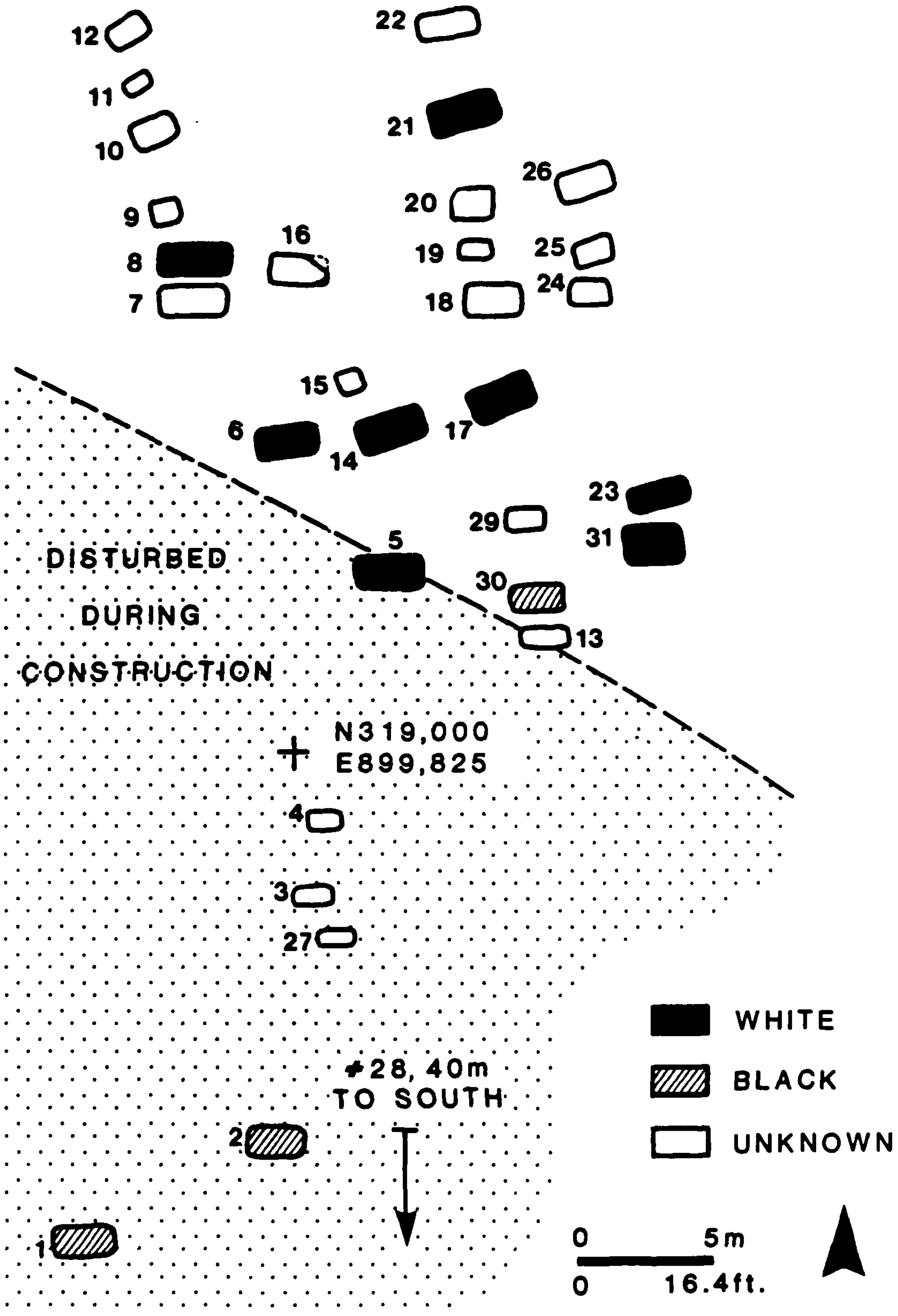

Figure 13. Distribution of Blacks and Whites in the Cemetery.

Age. The individuals buried at the Mt. Gilead Cemetery ranged in age from newborn infants to an elderly woman, approximately 84 years old. Figure 14 shows the age distribution of 28 of the 31 individuals. As the curve shows, infant and child mortality was high. Eighteen (64.3%) of the individuals were 11 years old or younger; five were newborns. There is an apparent gap between 11 and 30 years of age. (Burial 17 was a young adult female under 21 but her exact age could not be determined. She was not used in the age distribution in Figure 14). Most people, if they survived birth and childhood diseases, could expect to live well into middle age with a good chance of reaching relatively old age. The average age

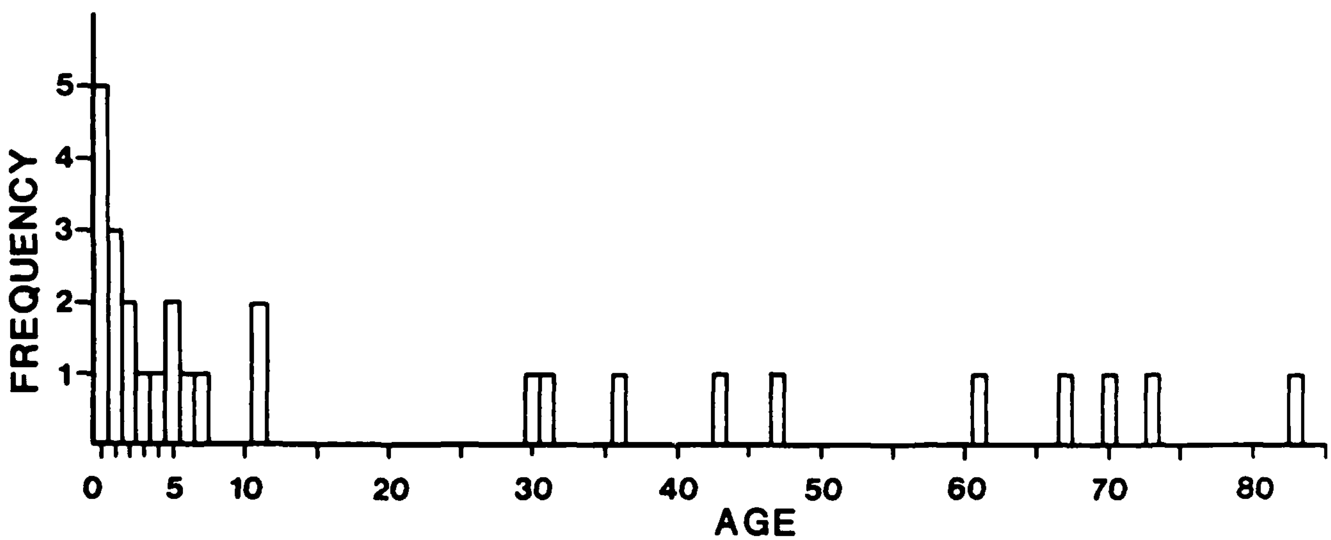

Figure 14. Age Distribution Plot.

of adult, white males (n=4) was 59.4 years old, while for adult, white females (n=3), the average age was 64.9. Adult black males, of which there were only two, averaged 33.3 years old. Although it is tempting, the sample of accurately aged adults from the Mt. Gilead Church is too small to draw any solid conclusions. Nevertheless, we were somewhat surprised at the longevity of some individuals. Figure 15 shows the distribution of three age groups across the cemetery.

Sex. We were able to determine the sex of ten of 11 adults in the cemetery. There were two black males, no black females, four white males, and four white females. Figure 16 illustrates the distribution of the sexes across the cemetery. Burials 1 and 2 at the south end, are the two black males. On the north end, there seems to be an interesting pattern. In only one instance were graves containing a male and female adults paired together (burials 23 and 31). Burials 7 and 8 were paired, but both were males and burials 14 and 17 were paired, but both were females. There is also a tendency among the whites for males to be buried to the north and females to the south. This pattern may be more perceived than real, however.

Health

The general health of the people from the Mt. Gilead Baptist Church Cemetery was not good. Although several individuals lived into old age even by today's standards, the quality of life may have suffered, due to the effects of disease, trauma, and infection. Diseases claimed many chil-

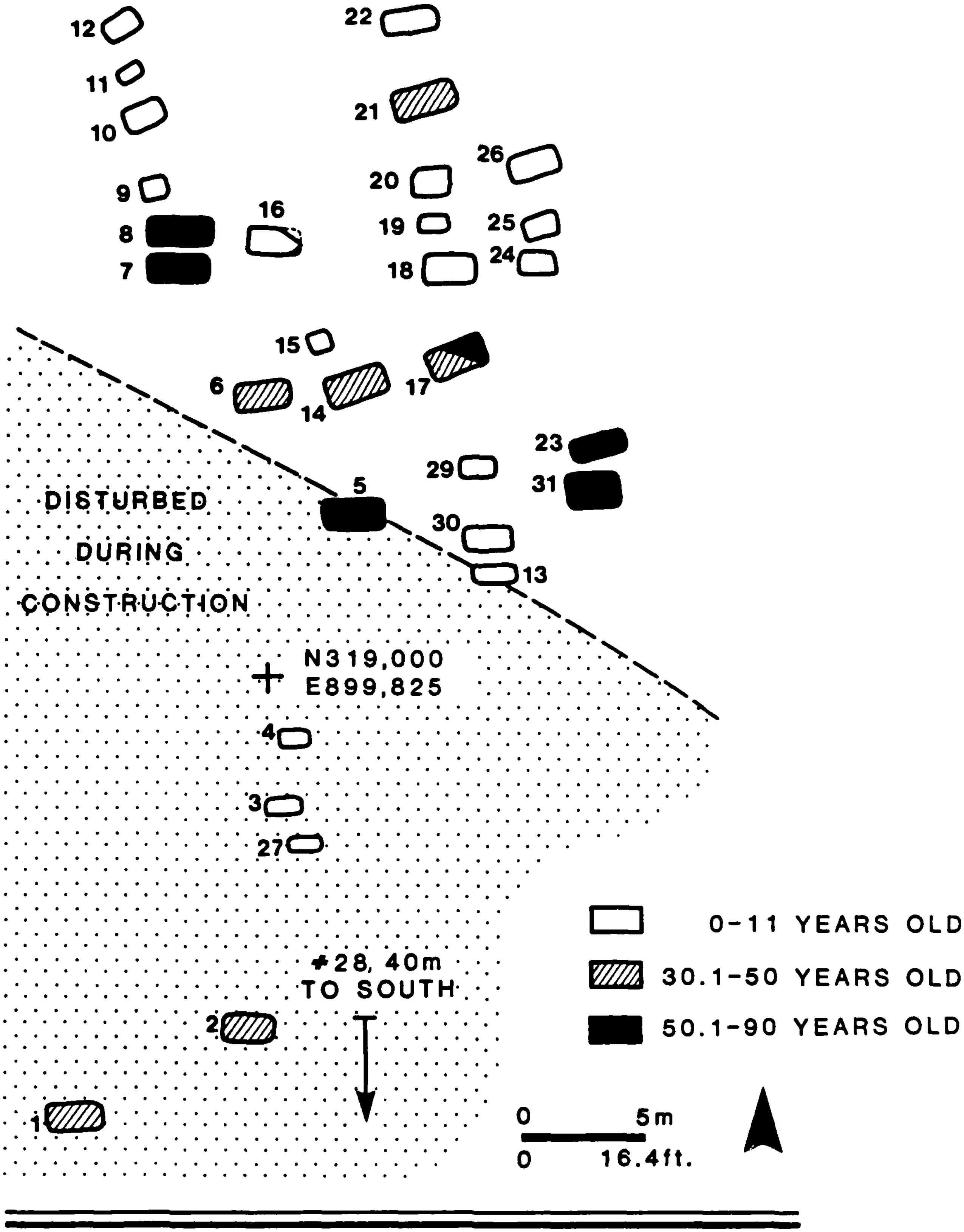

Figure 15. Distribution of Three Age Classes in the Cemetery.

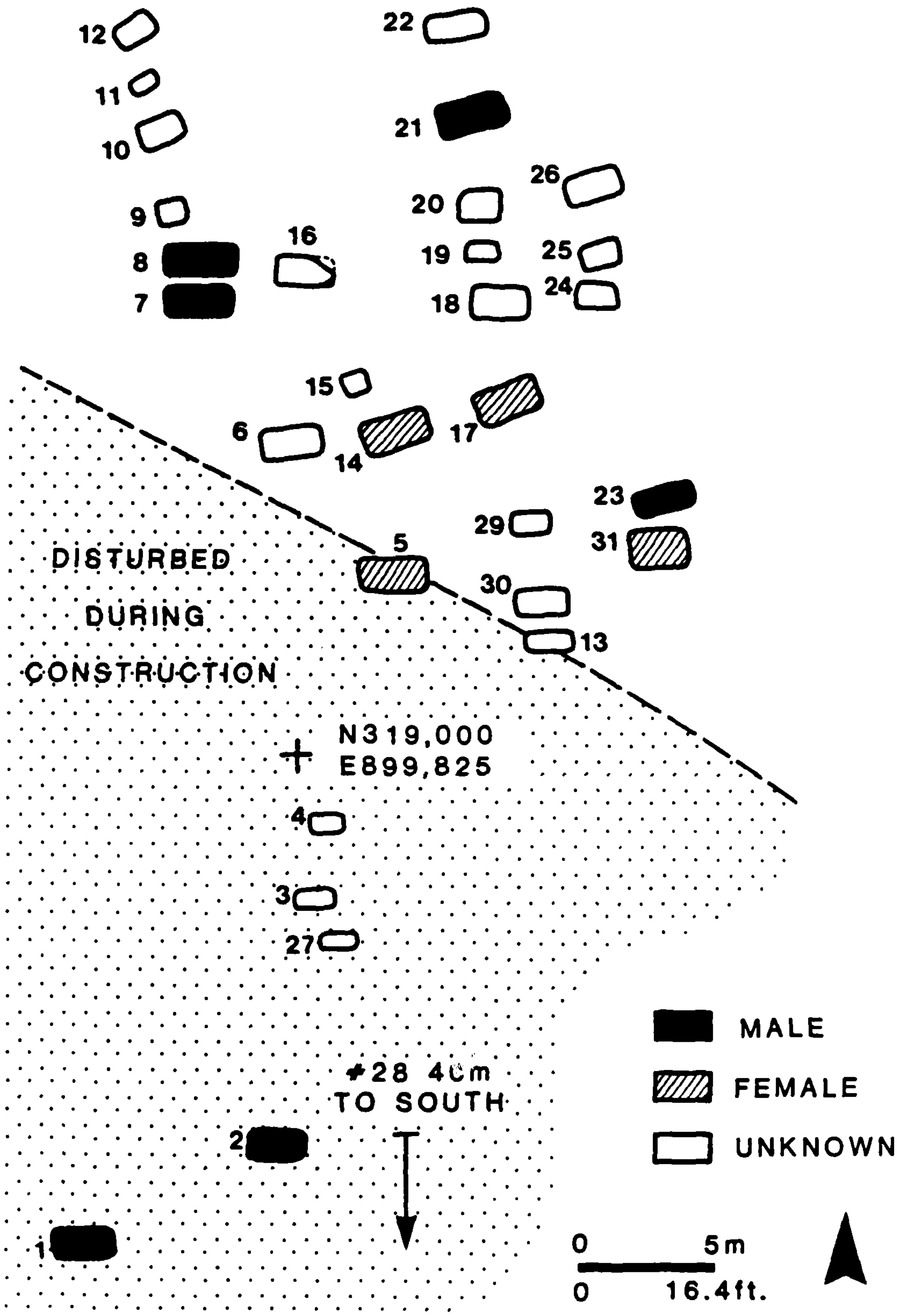

Figure 16. Distribution of Sexes in the Cemetery.

dren's lives. Of all the individuals who could be accurately aged (n=28), half were six years old or younger.

Accidental injury affected at least two individuals. Burial 7, a 61 year old white male, suffered an unreduced fracture of the left hip. The neck of the femur had broken and the leg had never healed properly due to insufficient immobilization after the injury. Consequently, the surfaces of the femoral head and shaft rubbed against each other until the bone was polished smooth. This man must have walked with a pronounced limp and probably suffered considerable pain during his lifetime.

Another trauma victim was burial 29. This child, between 5 and 6 years old, was probably killed by a shotgun blast. Two pellets were found in the grave, one next to the left femur and one in the left shoulder region.

A significant proportion of the people buried at the Mt. Gilead Cemetery suffered from one or more pathologies that are manifest in bone tissue. These include otitis mastoidea, osteoarthritic lipping, osteoarthritic bridging, and porotic hyperostosis. The youngest individual exhibiting any of these pathologies was burial 29, the 5 to 6 year old who died of gunshot wounds. The oldest was a 73 year old white male. Only one of the blacks exhibited any osteological pathologies (burial 1). Table 10 presents the data on 17 individuals over five years of age whose osteological pathologies could be studied.

Table 10. Frequency of Observed Pathologies.

Pathology	n	%
otitis mastoidea only	5	29.4
otitis mastoidea and osteoarthritic lipping	1	5.9
otitis mastoidea and porotic hyperostosis	1	5.9
osteoarthritic lipping only	3	17.6
osteoarthritic bridging only	1	5.9
no observed pathologies	6	35.3

We were not surprised to find that 29% of the individuals would be affected by osteoarthritic lipping or bridging. Arthritic diseases are common among people over forty and are aggravated by hard labor. What we were surprised to find was a high percentage of individuals affected with otitis mastoidea. This disease was widespread, affecting 41% of the 17 individuals who were 5 years old or older.

The mastoid is the bony projection located immediately behind the ear. It is comprised of a main cavity (antrum) and a number of closed and partially closed cavities (cells). It is a process of the temporal bone of the skull. An infection in the general area of the ear is called 'otitis.' Specifically, otitis mastoidea is an inflammation of the mastoid antrum and cells (Stedman 1972).

The primary focus of infection is usually the ear itself. 'Acute otitis media' is a relatively common malady. It

is known as 'swimmer's ear' when it begins on the external surface of the tympanic membrane. It can also develop on the internal surface of the tympanic membrane as a result of general upper respiratory infections, measles, and influenza.

If unchecked, the infection can easily spread into the adjacent mastoid antrum and its many small cavities (cells), becoming 'chronic pyogenic otitis mastoidea.' The infection is caused by microorganisms capable of producing pus, thus 'pyogenic' or 'suppurative.' Areas of slow blood flow, such as the mastoid, are ideal for the growth of such organisms. The infection spreads to the cortical wall of the mastoid and finally perforates it. The pus leaks between the bony surface and the periosteal membrane and a subperiosteal abcess is formed which raises the periosteum over an even larger area of the cortex (Steinbock 1976).

Separation of the periosteum leads to localized edema (excessive fluid accumulation) and ischemia (obstruction of the blood supply). The resulting pressure, together with a drop in pH and the presence of proteolytic enzymes from leukocytes, contribute to the death of bone tissue and absorption of trabeculae (Waldvogel et al. 1971). Granulation tissue forms, separating off pieces of dead bone which are called 'sequestra.' Exuberant new bone then forms in the subperiosteal space over the dead bone. This is called an involucrum and may be perforated by one to several crater-like openings or 'cloacae' through which pus drains into the soft tissues (Steinbock 1976:66).

Even if the infection is finally resolved, the shape and texture of the mastoid process is unlikely to ever return to its preinfenction condition.

Table 11 presents data on the seven individuals infected with otitis mastoidea.

As can be seen in the above table, otitis mastoidea affected both young and old with ages ranging from 5.5 to 73.5 years old. Our data on the distribution between the sexes is limited because of small sample size; nevertheless, two males and one female were affected.

Four of the individuals suffered bilateral otitis mastoidea, while three suffered only unilateral infections. The left and right mastoid processes are nearly equal in frequency of occurrence of the disease.

Table 11. Individuals Exhibiting Otitis Mastoidea.

Burial	Sex	Age	Degree of Infection	Copper (ppm)
6	?	47.6*	left more active than right	28.32
8	m	73.5*	left only	3.66
13	?	7.0	left deep and spongy	2.44
18	?	11.0	left and right	no data
21	m	31.9*	right chronic abcess	159.07
29	?	5.5	left more than right	1.68
31	f	67.4*	right more than left, large resorption pits	6.53

* $\pm$ 9.19

We compared the results of the trace element analysis to those infected with otitis mastoidea and discovered that burial 21 exhibited a very high concentration of copper in the bone tissue (159 ppm compared to a population mean of 15.62 ppm). As mentioned before, Underwood (1977) states that copper buildup in tissue during chronic infection is well documented. Burial 21 exhibited a chronic abcess of the right mastoid process, indicating severe infection. We believe that otitis mastoidea was active at the time of death and may have been the cause of death in this individual.

There may be several causes of otitis mastoidea, but one which is certainly worthy of consideration is waterborn microorganisms. Upatoi Creek flows near the cemetery. Perhaps swimming, bathing, and even baptisms in the creek would have allowed a variety of possible vectors into the inner ear where infection could easily spread to the mastoid process. Whatever the cause, otitis mastoidea certainly caused pain, suffering, and, possibly, death in many Mt. Gilead Church members. This pathology deserves more attention than we can give it in this report. Further research into the causes, effects, and distribution of this disease is certainly warranted.

Diet

Through the application of trace element analysis, we have been able to shed a little light on the differences in diet between a white population who lived in the first half of the nineteenth century and two black individuals who lived

during the last half of the same century. Our sample size is small and might be misleading; nevertheless, it appears that the diet of the blacks may have been more plant-oriented than that of the earlier whites. The Mt. Gilead Baptist Church members probably were able to supplement their diet with more meat (livestock and wild game) than the blacks who lived there much later.

Stature

We were able to obtain estimates of height for eight adult individuals, five males, three females, and one of unknown sex. For males (black and white), the range was 177.8 cm (70 in) to 162.6 cm (64 in) with an average height of 172.2 cm (67.8 in). For females, the range was 165.1 cm (65 in) to 157.5 cm (62 in) with an average height of 161.5 cm (63.6 in).

Burial Customs

The layout and plan of the Mt. Gilead Cemetery reflects contemporary practices of the nineteenth century. The graves were arranged in relatively ordered fashion along north-south running rows. Heads were always oriented to the west. Grave markers were probably made of wood, as no stone markers were present and suitable stone is not locally available in the surrounding sand hills.

Graves were dug from 4-6 ft deep (estimated) and were straight-sided. At the bottom of the grave, a shallow recess in the floor was dug in which the coffin was placed. Boards were then sometimes placed over the coffin and across the

wider grave bottom to add strength and prevent the coffin from collapsing prematurely. We were often able to see the coffin-shaped recess at the bottom of the grave and, in one instance, the boards were preserved above the coffin. This practice was also documented at the Oakland Cemetery in Atlanta (Blakely and Beck 1982).

Two styles of coffin shape were present at the cemetery, hexagonal and rectangular. Figure 17 shows the distributions of both styles. According to Blakely and Beck (1982), the hexagonal shape is earlier than the rectangular one. But it is also possible that style was influenced more by the coffin maker's skill and preference. There were 16 hexagonal coffins and eight rectangular ones. The latter seemed to cluster on the east side of the cemetery. Hexagonal coffins were present in all portions of the cemetery.

Three coffins were more elaborate than the others. Those associated with burials 5, 17, and 31 were upholstered on the outside with a fabric held in place by brass tacks. Only small fragments of the fabric were preserved, all by the metallic salts (such as copper) behind the brass tacks. All three individuals were adult females, two were elderly (67.4 and 83.9 years old) and the other was a young adult (under 21). It seems that some adult females were accorded a higher status, at least in death, than the other people buried in the cemetery.

There were 26 cases where data was available on clothing. Of these, 15 had evidence of clothing (or shroud) and 11 had no evidence of clothing. Most of the newborns and

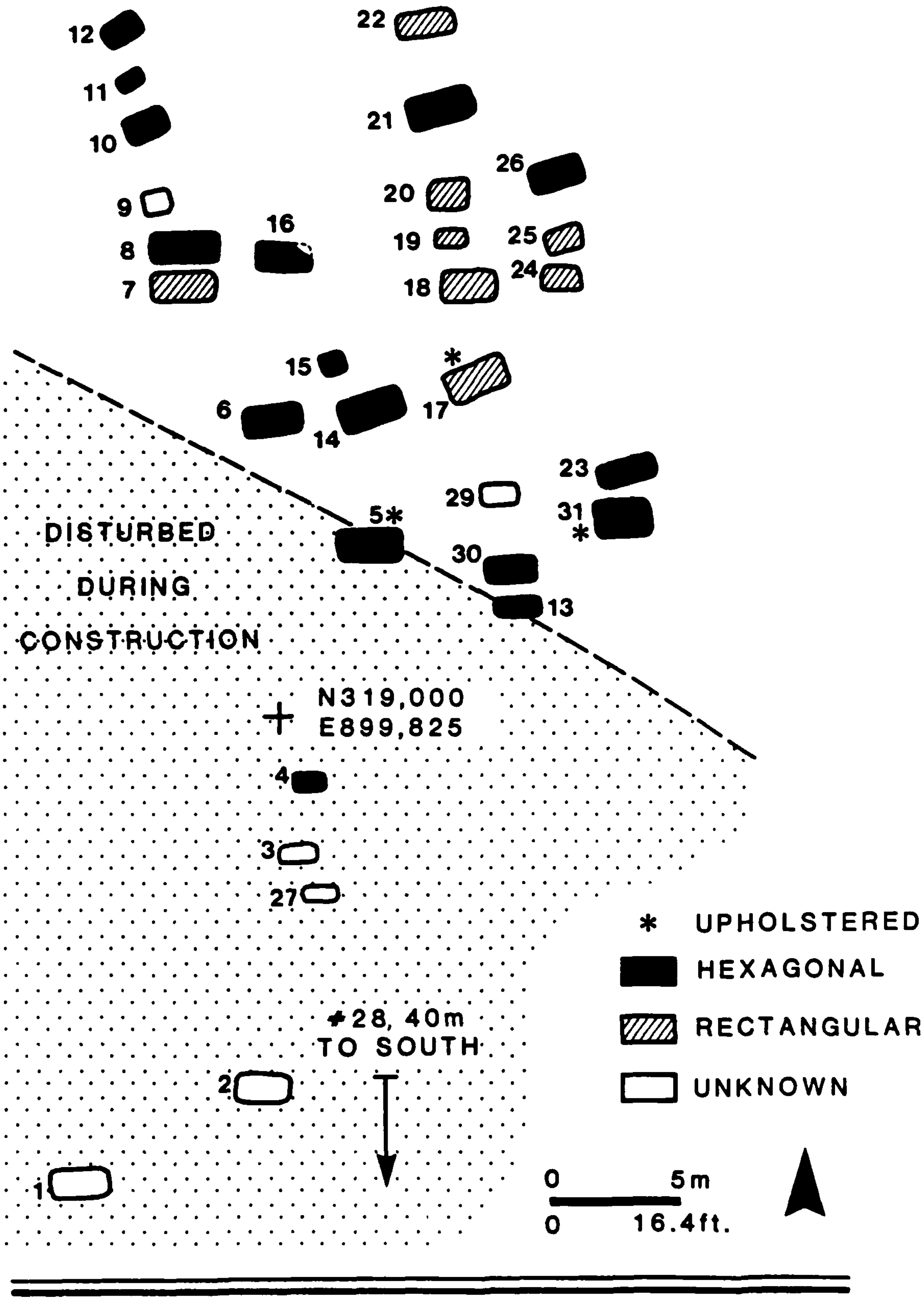

Figure 17. Distribution of Hexagonal and Rectangular Coffins in the Cemetery.

older children were probably buried in a shroud or blanket, as evidenced by brass straight pins with the burials. Only four burials had associated buttons, suggesting trousers and/or coats. Two burials had minute traces of shoe leather present. One of these was a 1.5 to 2 year old child and the other a 67.5 year old female.

CONCLUSIONS AND RECOMMENDATIONS

The Mt. Gilead Cemetery has produced significant contributions to the study of life and death in the nineteenth century Fall Line Hills of western Georgia. The information revealed in this report could only have come from careful scientific study of the individuals buried in the cemetery. Traditional burial relocation methods are not designed to produce information of this sort. Even though we consider the project to have been a success, there are several improvements that can be made in future projects.

Laboratory Analysis

First and foremost, the skeletal remains should be removed to a well equipped laboratory for intensive study. Analysis in the field simply does not offer enough time or the necessary facilities (such as comparative collections, radiography and controlled lighting for photo-documentation). A thorough analysis of pathologies such as otitis mastoidea requires more than two hours in the field. It requires weeks or months of continued re-examination, comparison, and consultation to properly interpret complex diseases.

Trace Element Analysis

Other treatments of the samples and data may be appropriate for future work. In this study, it was enigmatic that the poor quality bone was elevated in Iron (Fe) and Manganese

(Mn) content, yet the acid-labile extracts of soil that were employed in this study were not elevated in Fe and/or Mn content. Possibly, a total digestion of soils for ICP assays or the employment of neutron activation analysis to obtain a total trace element content of soils would help solve this problem.

Also, the evaluation of the poorest quality bones in this study may be inappropriate. They were retained in this study so as to increase sample size; however, they were obviously the most impacted by diagenetic processes. Though not included in this report, the percent of ash data on these bones were generated. The bones ranked 3 and 2 averaged approximately 65% ash, whereas the bones ranked 1 averaged approximately 75% ash. This is probably due to decomposition of the proteinaceous framework in the poor quality bones. Therefore, it may be more appropriate, in treatment of archeological bone, to report trace elemental content on an ash weight basis, or as a ratio against calcium (Ca), the element in highest concentration in bone.

With these adjustments in mind, future utilization of these techniques in archeology and anthropology could provide a wealth of hard evidence about our forebearers that heretofore could only be inferred.

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AD-A167 574 THE MT GILEAD CEMETERY STUDY: AN EXAMPLE OF BIOCULTURAL ANALYSIS FROM WES..(U) SOUTHEASTERN ARCHEOLOGICAL SERVICES INC ATHENS GA W D WOOD ET AL. FEB 86 2/2

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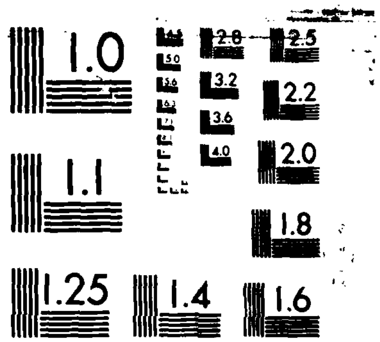

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APPENDIX I

Burial Field Record Form

BURIAL FIELD RECORD FORMS

K.R. Burns

CONTENTS

PATHOLOGY & TRAUMA -- Recording Guidelines

Wherever pathology or trauma are recorded, the description should include all four of the items listed below.

1. Mark the location of the lesion on the appropriate drawing.

2. Shade the extent of the lesion. A verbal description may be necessary also.

3. Describe lesion(s) using the terms listed below.

   (1) resorptive or osteolytic
   (2) proliferative

4. Try to ascribe a cause.

   (1) degeneration
   (2) infection
   (3) trauma
   (4) neoplasm
   (5) nutritional deficiency
   (6) metabolic disorder
   (7) birth defect

5. Indicate the status of the lesion.

   (1) active
   (2) remodeled

INITIAL OBSERVATIONS

Site Descriptor: Date(MM/DD/YY): ___/___/___

Burial Number: Starting time:

Recorder(s): Ending time:

1. Overall condition: good____; poor____; fragmented____; comminuted____;

2. Position (extended, flexed, etc.; note arm position also):

3. Orientation (head - feet):

4. Total length of burial (_________ to __________): ______ cm.

5. Age category (check one):

   a. infant ______
   b. child ______
   c. adolescent ______
   d. adult ______
   e. elderly adult ______

6. Comments about the burial as a whole:

DENTITION

1. Condition - include taphonomic effects such as cracking, color changes or exfoliation.

2. Eruption sequence - circle the most representative drawing (page 4).

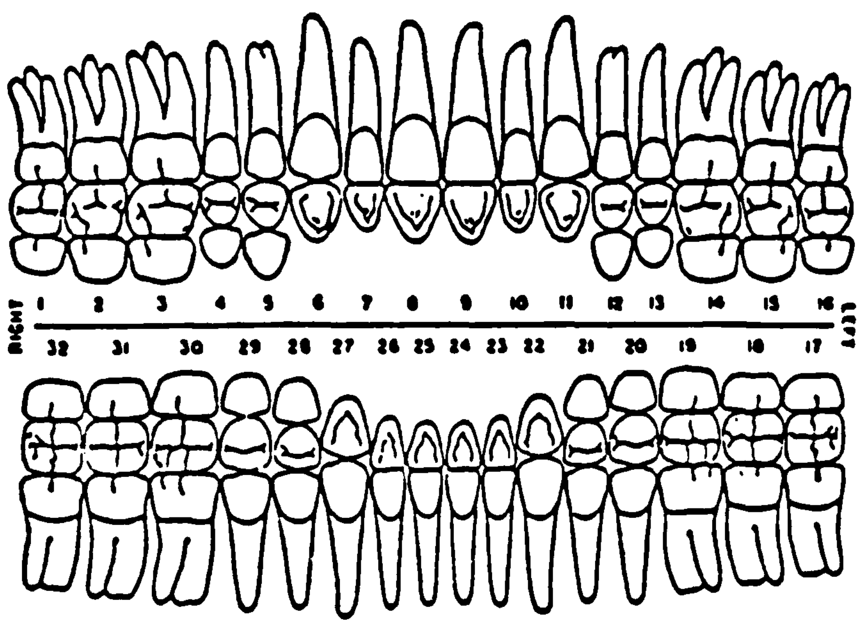
3. Occlusion (check one): Class #1____; #2____; #3____;

4. Describe any edentulous ridge:

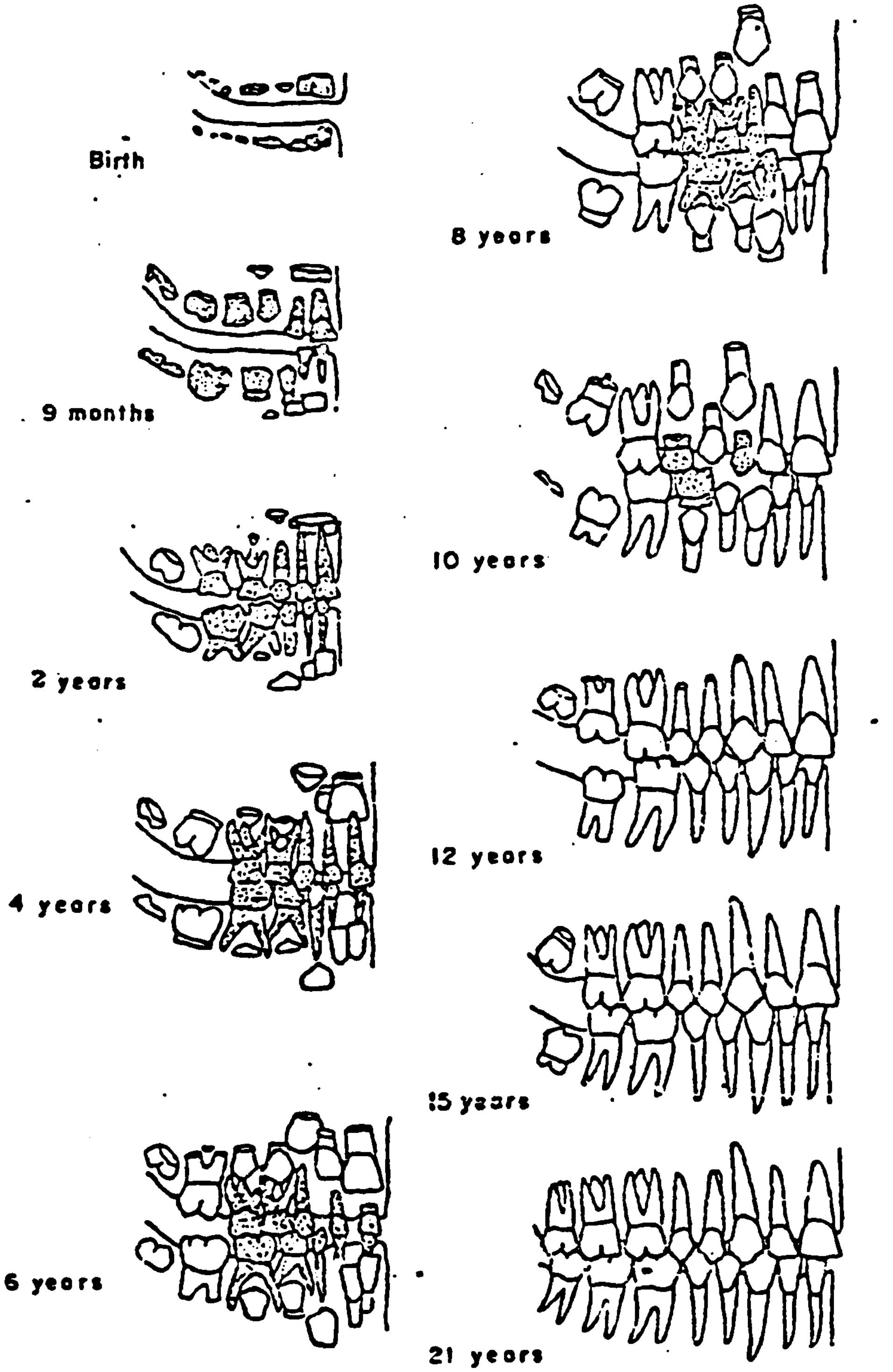
5. List nonmetric traits (such a Carabelli's cusp, agenesis, or shovelling):

6. Fill in dental chart using the following key:

(1) Caries . . . . shade the area of the lesion.
(2) Apical Abcess . . . . circle the appropriate root.
(3) Missing, ante-mortem X
(4) " post-mortem . . . . .U
(5) Attrition, none visible 0
(6) " enamel only 1
(7) " exposed primary dentin 2
(8) " reparative dentin exposure 3
(9) " no crown remaining 4



DENTAL ERUPTION SEQUENCE



(after Schour and Massler)

CRANIUM

1. Condition: good___; poor___; fragmented___; comminuted___;

2. Pathology or trauma: Use pages 7 & 8.

3. Non-metric traits:

Sexual characteristics:
(1) Brow ridge shape: rugged ____; smooth ____; ?? ____;
(2) Orbital borders: rounded ____; sharp ____; ?? ____;
(3) Chin shape: square ____; rounded ____; pointed ____;

Measure of biological distance (Buikstra, 1976):
(4) Asterionic bone . . . . L ____; R ____;
(5) Parietal notch bone . . . . L ____; R ____;
(6) Supraorbital foramen . . . . L ____; R ____;
(7) Multiple mental foramina . . . . . . L ____; R ____;
(8) Mylohyoid arch . . . . L ____; R ____;
(9) Divided hypoglossal canal . . . . . L ____; R ____;
(10) Multiple zygomaticofacial foramina . L ____; R ____;
(11) Pterygoalar spurs . . . . L ____; R ____;
(12) Ossicle at lambda . . . . Y ____; N ____;
(13) Superior sagittal sulcus flexes R. . Y ____; N ____;
(14) Posterior bridging on atlas . . . . L ____; R ____;

Racial traits (Todd & Tracy, 1932):
(15) Supraorbital ridge . undulating ____; mesa ____;
(16) Upper Orbital margin . . .sharp ____; blunt ____;
(17) Glabella . . . . .rounded ____;depressed ____;
(18) Frontonasal junction . . .plain ____; beetling ____;
(19) Inter-orbital distance . . wide ____; narrow ____;

4. Suture closure - endocranial (check only if fusion is complete)

(1) Metopic . . . . (2 years) . . . . ______
(2) Basilar . . . . . . (18-20 years) . . . . ______
(3) Coronal . . . . . . (24-38 years) . . . . ______
(4) Sagittal . . . . . (26-41 years) . . . . ______
(5) Lambdoidal . . . . (26-52 years) . . . . ______
(6) Spheno-parietal . . (29-65 years) . . . . ______
(7) Squamous . . . . . (37-51 years) . . . . ______

5. Cranial measurements:

Discriminant function analysis for race (Giles & Elliot, 1962)
(1) Basion - prosthion . . . . ______ mm.
(2) Glabella - occipital length . . . . ______ mm.
(3) Maximum width . . . . ______ mm.
(4) Basion - bregma height . . . . ______ mm.
(5) Basion - nasion . . . . ______ mm.
(6) Maximum bizygomatic diameter . . . . . . ______ mm.
(7) Prosthion - nasion . . . . ______ mm.
(8) Nasal breadth . . . . ______ mm.

Sexual trait
(9) Length of mastoid from upper border of auditory meatus in Frankford plane . . . ______ mm.

6. Application of cranial measurements:

Formula for distinguishing between the skulls of black & white <u>males</u>

(1)____(3.06) + (2)____(1.6) + (3)____(-1.9) + (4)____(-1.79) +
(5)____(-4.41) + (6)____(-0.1) + (7)____(2.59) + (8)____(10.56) = ______

Formula for distinguishing between the skulls of Indian & white <u>males</u>

(1)____(0.1) + (2)____(-0.25) + (3)____(-1.56) + (4)____(0.73) +
(5)____(-0.29) + (6)____(1.75) + (7)____(-0.16) + (8)____(-0.84) = ______

Formula for distinguishing between the skulls of black & white <u>females</u>

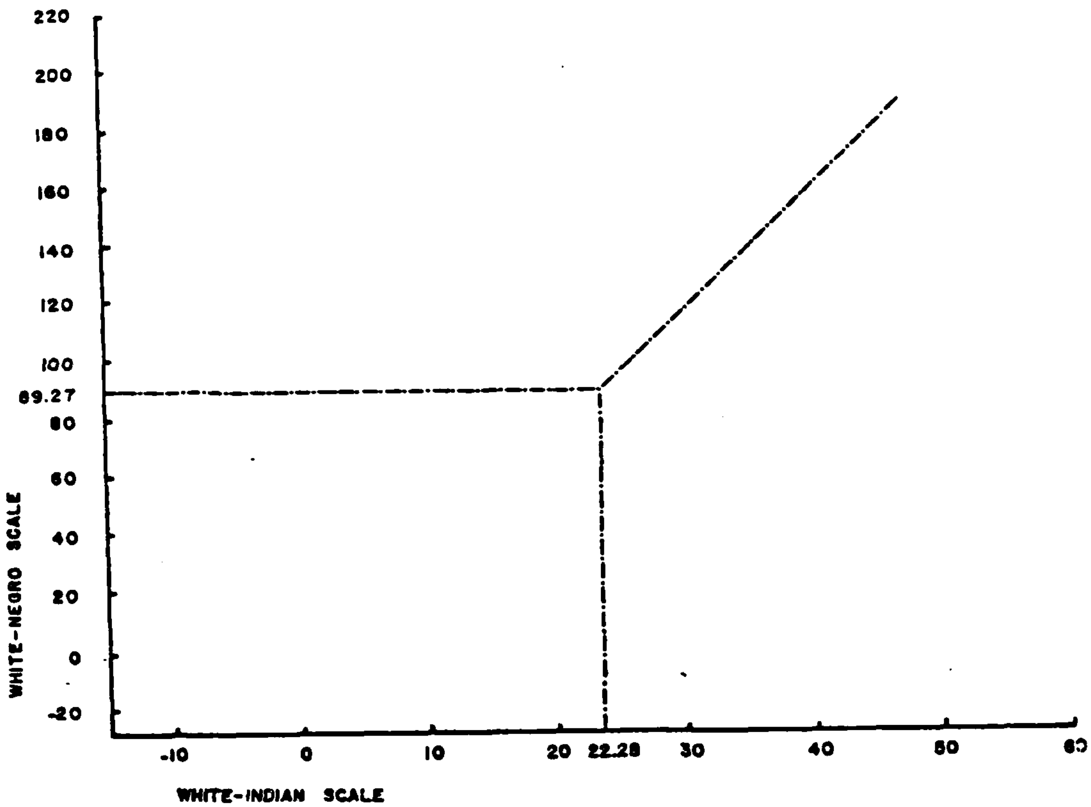
(1)____(1.74) + (2)____(1.28) + (3)____(-1.18) + (4)____(-0.14) +
(5)____(-2.34) + (6)____(0.38) + (7)____(-0.01) + (8)____(2.45) = ______

Formula for distinguishing between the skulls of Indian & white <u>females</u>

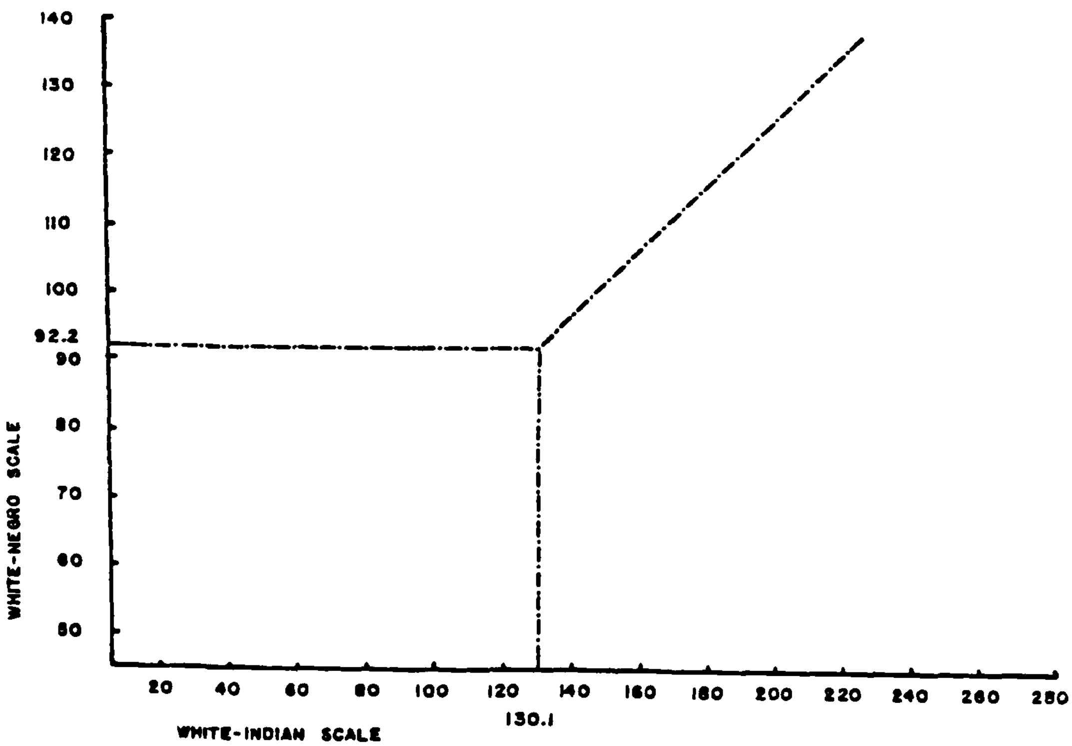
(1)____(3.05) + (2)____(-1.04) + (3)____(-5.41) + (4)____(4.29) +
(5)____(-4.02) + (6)____(5.62) + (7)____(-1.0) + (8)____(-2.19) = ______

Plot the sums on the graphs (next page).

DISCRIMINANT FUNCTION ANALYSIS OF RACE

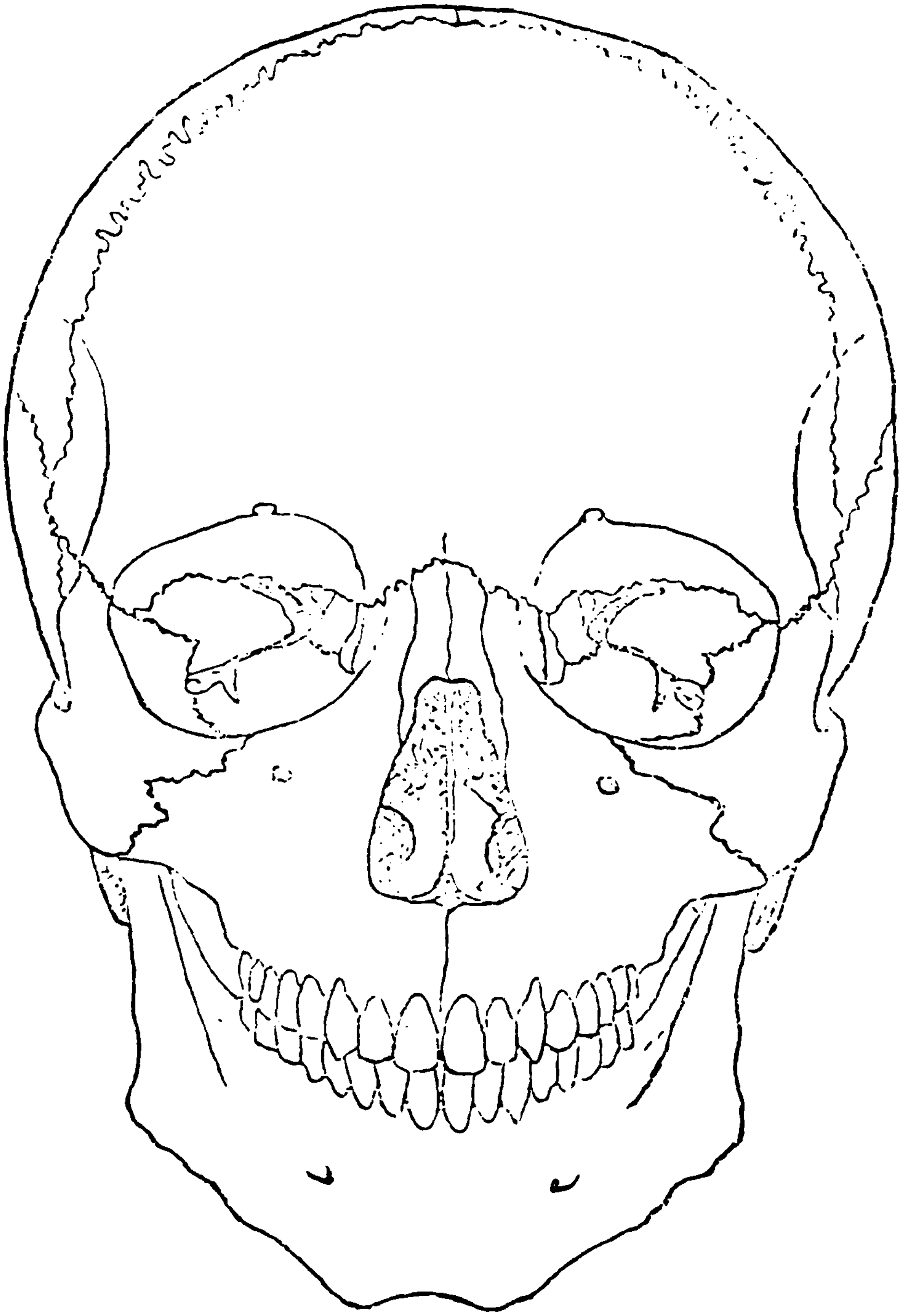


Sectioning point layout for male white-Indian-Negro determination.

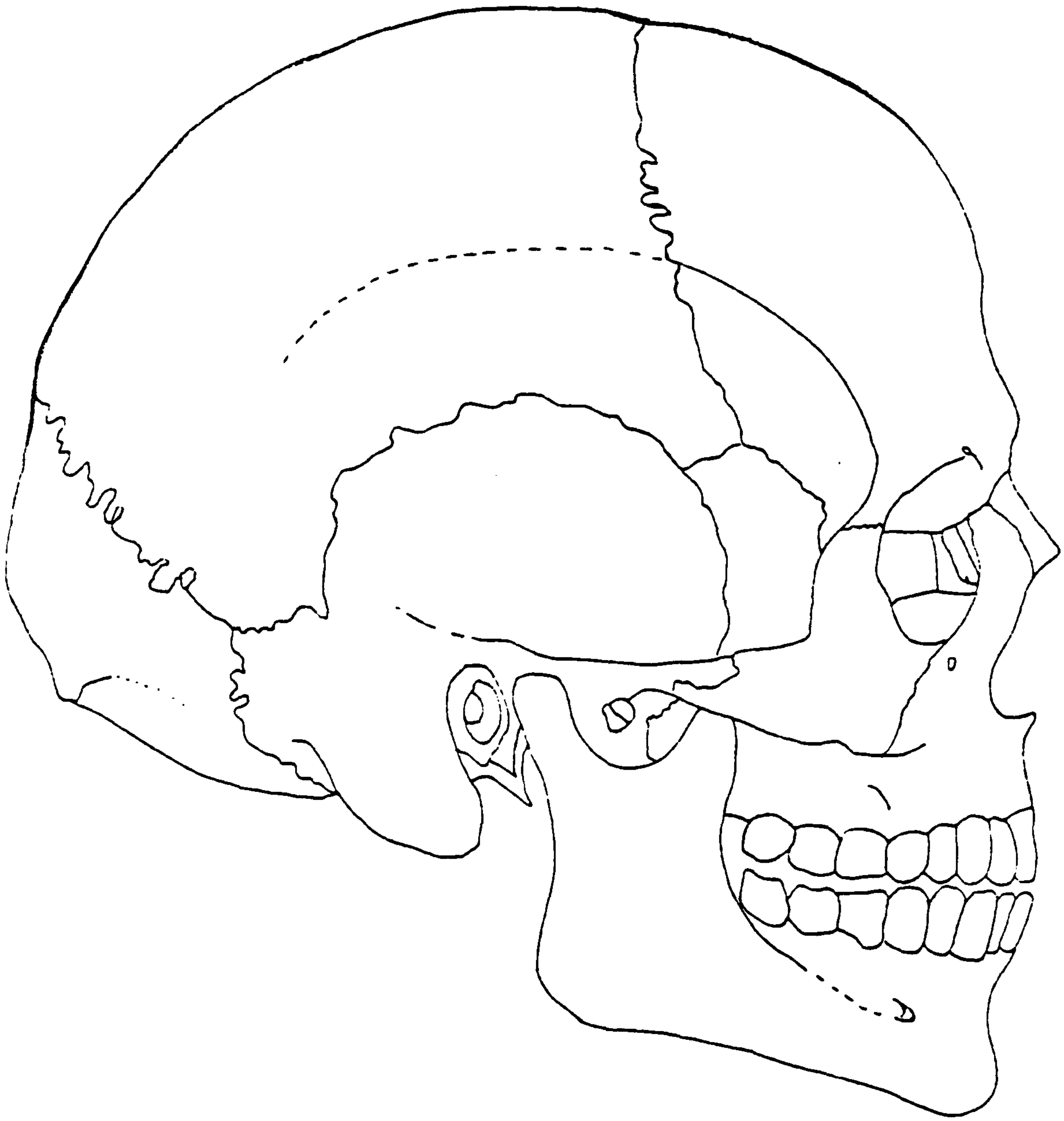


Sectioning point layout for female white-Indian-Negro determination.

FRONTAL VIEW of SKULL



LATERAL VIEW of SKULL



INNOMINATE

1. Condition: good___; poor___; fragmented___; comminuted___;

2. General Observations

   (1) Sciatic notch: trace or measure . . . . ____ degrees

   (2) Pubis shape: long-squared____; short-triangular____;

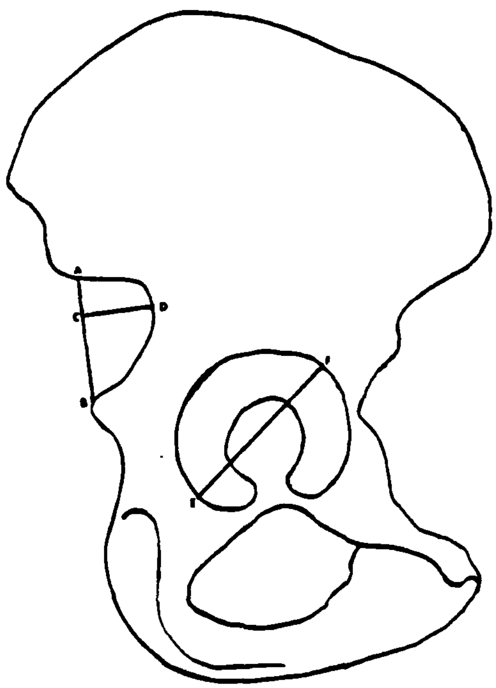
   (3) "Parturation scarring": present____; absent____;

   (4) Pre-auricular sulcus: present____; absent____;

3. Iliac crest: unfused____; partially fused____; fused____;

4. Pelvic measurements for sexing (Taylor & DiBennardo, '84)

   (1) Notch height (A-B). . . . . ______ mm.
   (2) Notch position (B-C). . . . . ______ mm.
   (3) Acetabular diameter (E-F) . . . . ______ mm.



POST CRANIAL SKELETON (other than Innominate)

1. Pathology or trauma (describe on pictures of skeleton)

2. Epiphyseal union
   Key: U = unfused; P = partial fusion; C = complete fusion
   left side/right side

   (1) clavicle . . . . medial ___/___; distal ___/___;
   (2) humerus. . . . . . proximal ___/___; distal ___/___;
   (3) radius . . . . . . proximal ___/___; distal ___/___;
   (4) ulna . . . . proximal ___/___; distal ___/___;
   (5) femur. . . . . . . proximal ___/___; distal ___/___;
   (6) tibia. . . . . . . proximal ___/___; distal ___/___;
   (7) fibula . . . . . . proximal ___/___; distal ___/___;

3. Femur (children: diapheseal length; adults: total length)

   Diapheseal length . . . . L ______ mm.; R ______ mm.
   Total length. . . . . L ______ mm.; R ______ mm.
   Greater trochanter diameter . L ______ mm.; R ______ mm.

4. Tibia (adults). . . . . L ______ mm.; R ______ mm.

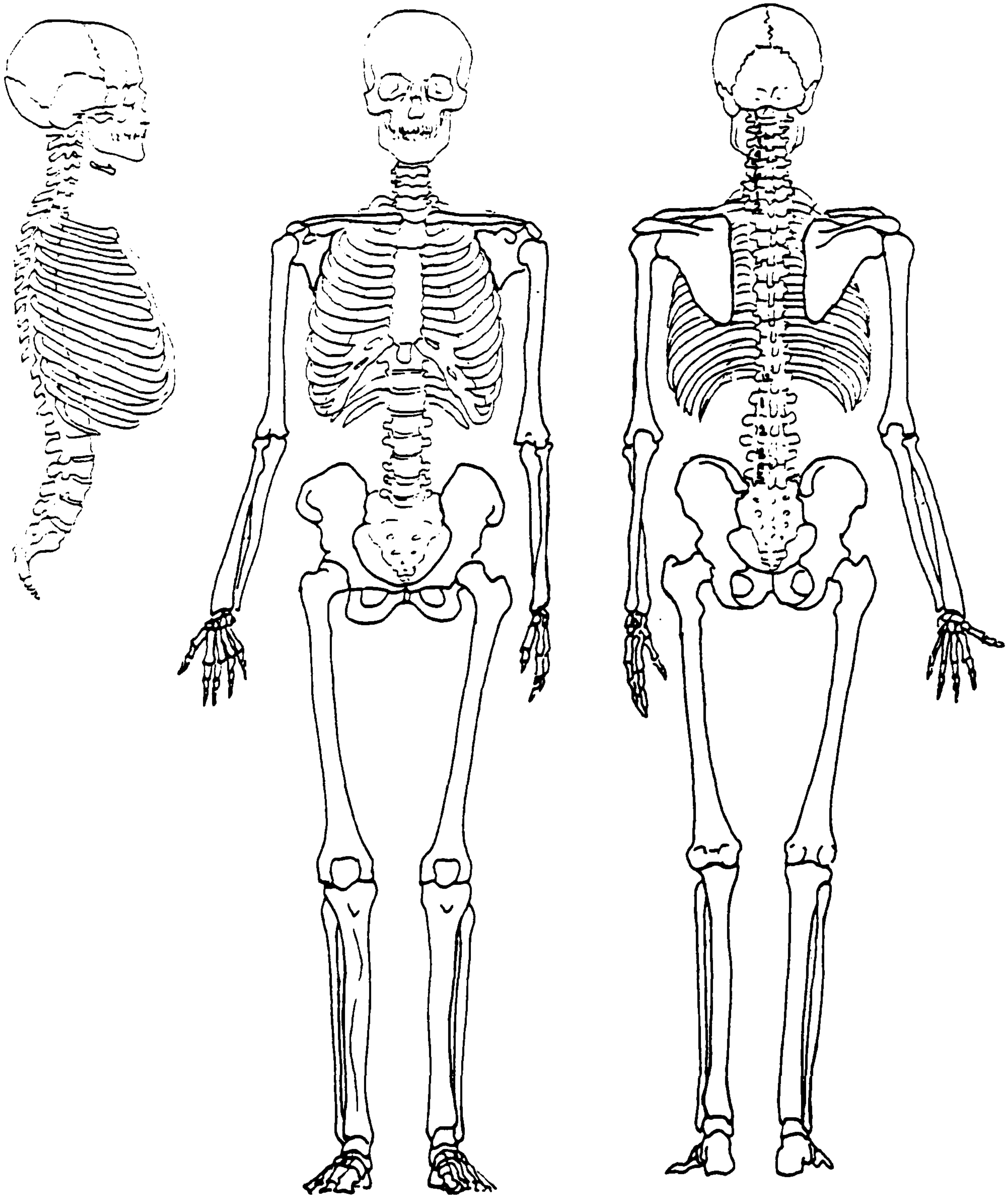
5. Fibula (adults) . . . . L ______ mm.; R ______ mm.

6. Humerus (adults). . . . . L ______ mm.; R ______ mm.

7. Radius (adults) . . . . L ______ mm.; R ______ mm.

8. Ulna (adults) . . . . L ______ mm.; R ______ mm.

ANTERIOR and POSTERIOR VIEWS of SKELETON



APPENDIX II

Membership List of the Mt. Gilead Baptist Church

1832-1849

Membership Mt. Gilead I 03-24-1832 to 12-1-1849

Name	Date Received (R)	Date Dismissed (D)	Notes
Israel Chapman	Charter	---	last mention in Church minutes 7-27-39
Nancy Chapman	Charter	---	member at County Line Church 1850. Died Muscogee Co. 1-51 (will)
Paschal Wall	Charter	09-26-35	[member Mt. Olive Church (Rogers 1933)]
John Sr. Wall	Charter	09-26-35	[member of Mt. Paran, returned to County Line Church 3-2-50]
Dorcas Wall	Charter	09-26-35	[member of Mt. Paran, returned to County Line Church 3-2-50]
Maddox Wall	Charter	---	founder of Mt. Paran Church, 12-18-37. Buried at Mt. Paran cemetery
Ebenezer Nelson	Charter	12-21-33	(R) (D) 10-25-34 08-26-37 02-23-39 12-22-39
Sarah Ann Nelson	03-24-32	12-21-33	(R) (D) 10-25-34 08-26-37 02-23-39 12-22-39
Sarah McDuffie	Charter	02-23-39	
Elizabeth Greer	Charter	?	"sister (blank) Greer formerly granted letter but not recorded" 8-31-50 minutes
Hannah Greer	Charter	?	"sister (blank) Greer formerly granted letter but not recorded" 8-31-50 minutes
Joseph Coleman	Charter	---	clerk

Name	Date Received (R)	Date Dismissed (D)	Notes
Benj. G. Alford	03-24-32	10-27-32	
Nancy Alford	03-24-32	10-27-32	
John Barksdale	03-24-32	11-24-32	
Martha A. F. Barksdale	04-21-32	11-24-32	
Nancy Yarborough	03-24-32	?09-23-37	"Mary" Yarborough
Hannah Oates	03-24-32	---	
Lucy Roberts	04-21-32	---	
Mary Cabannis	04-21-32	11-22-34	
John Nelson	05-26-32	09-23-37	
Sarah Jane Nelson	05-26-32	09-23-37	
George Cabannis	05-26-32	12-27-36	"George Cabannis and Mary Allen"
Ellen Burke	05-26-32	11-24-32	Eleanor B. Burke (R)09-26-35 (D)08-23-37 member at Mt. Paran
Nancy Greer	05-26-32	01-25-40	(R)01-22-42 (D)?date "sister Nancy Greer formerly granted letter but not recorded" 8-31-50 minutes
Mary Green	05-26-32	11-24-32	
William Green	05-26-32	11-24-32	
Joel Moye (Moey)	05-26-32	?	member of County Line Church, 1850.
Selah Moye (Moey)	05-26-32	?	member of County Line Church, 1850.
John Parmer	07-21-32	---	cited for insubordination 7-2-42
Barber Parmer	07-21-32	?date	"Barby Palmore formerly granted letter but not recorded" 8-31-50 minutes

Name	Date Received (R)	Date Dismissed (D)	Notes
Nancy Lee	07-21-32	---	
Eliza Oates	07-31-32	?10-08-36	Eliza Cates
Dorcas Peed	01-26-33	09-26-35	
Lydia Nelson	01-26-33	12-21-33	(R)03-22-34
Susanna Nelson	01-26-33	08-26-37	
Jesse Nelson	01-26-33	08-26-37	
Joseph Jones	04-27-33	10-26-39	
Jane Jones	04-27-33	10-26-39	
Isham Barker	04-27-33	08-21-33	
Palitire Webb	06-18-33	07-02-42	
Cornelius Canady	---	07-27-33	
Sarah Gray	07-27-33	01-24-35	
sister Jones	11-23-33	11-25-43	
Trecy Kenedy	03-22-34	08-25-38	
Mary Jones	03-22-34	04-03-42	member of Mt. Paran Church
Jemima McCoy	06-31-34	---	member of Mt. Paran Church later Mt. Olive
sister Charlotte	06-31-34	04-20-38	Charlotta Peacock member of Mt. Paran Church
Candace Dunning	06-31-34	---	
Timothy Dunning	10-25-34	12-22-39	
Martha Pate	12-27-34	?	County Line Church 1850 - Martha Pate m. 1/41 Isaac Gallops
Nancy Diggins	---	01-24-35	
Mary Higdon	01-24-35	01-23-36	

Name	Date Received (R)	Date Dismissed (D)	Notes
Micajah Allen	01-24-35	01-24-35	[?dates as in my notes, not doubly checked]
Isaac Powell	08-22-35	11-24-38	1840 census Tallapoosa Co., Al pg.
Sarah Powell	08-22-35	11-24-38	
Joseph Yarborough	08-28-36	01-07-37	
Thomas Guice	11-13-36	05-13-37	
brother Scarborough	08-26-37	---	Ivey Scarborough member Mt. Olive, 1842
Lydia Newberry	04-03-42	---	

This ends membership roster for Mt. Gilead I

APPENDIX III

Trace Element Analysis Summary Data

Steve R. Lee

Ethnographical, Pathological, Bone Quality and
Soil & Bone Elemental Composition of Persons Exhumed
from Mt. Gilead Cemetery

Burial #	1			2		
Sex	Male			Male		
Age approx. yrs	35			30		
Race	Black			Black		
Mastoiditis	0			0		
Bone Quality[1]	3			3		
Molar Ca/P Ratio[2]	1.58			1.61		
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.60	--	--	--	--
Elemental Composition[4]						
Al	249.00	525.76	--	159.90	--	--
Ca	30.27[4]	477.90	--	28.13[4]	--	--
Fe	303.60	116.40	--	245.42	--	--
K	0.00	7.70	--	0.00	--	--
Mg	3020.30	15.70	--	2058.03	--	--
Na	5229.50	64.70	--	3187.28	--	--
P	14.39[4]	209.90	--	13.08[4]	--	--
Zn	500.40	1.10	--	207.40	--	--
Sr	188.70	0.60	--	177.41	--	--
Se	30.20	1.30	--	29.95	--	--
Co	1.53	0.13	--	1.58	--	--
Cr	10.60	0.46	--	8.04	--	--
Cu	29.10	0.36	--	11.07	--	--
Mn	47.30	1.19	--	20.82	--	--
Mo	1.70	0.00	--	1.41	--	--
Ni	2.20	0.03	--	2.49	--	--
As	5.70	5.40	--	4.37	--	--
Cd	0.80	0.007	--	0.48	--	--
Pb	38.20	4.81	--	32.79	--	--
Si	0.00	29.79	--	0.00	--	--
Sn	6.20	0.00	--	5.69	--	--
Ba	29.80	8.62	--	27.89	--	--

1 3=Well Preserved Femur; 2=Fair Preservation - cortical erosion & darkening observed; 1=Poor Preservation - fragmented, high moisture, darkened, crumbly.

2 Ca/P is a measure of bone maturity: Ca/P @ 1.67 = mature, Ca/P < 1.67 = degree of maturity.

3 Soil in = soil sample approx. 25 cm adjacent to femur section used for analyses; soil out = soil outside burial pit.

4 Concentration in ppm except for bone Ca & P, which are in %.

Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #	5			6		
Sex	Female			Female		
Age approx. yrs	85			45		
Race	White			White		
Mastoiditis	0			1		
Bone Quality[1]	2			2		
Molar Ca/P Ratio[2]	1.58			1.58		
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.30	4.10	--	4.10	4.00
Elemental Composition[4]						
Al	356.82	364.86	396.06	133.69	340.36	368.66
Ca	26.19[4]	100.10	55.69	27.42[4]	92.14	40.19
Fe	265.27	69.73	28.86	69.86	180.30	34.44
K	7.21	0.00	0.00	3.79	0.00	0.00
Mg	1162.16	4.01	3.81	1680.20	3.34	3.51
Na	2644.20	58.66	68.82	2966.78	80.68	65.58
P	12.46[4]	53.96	13.12	13.01[4]	115.30	10.66
Zn	272.03	1.69	0.37	196.40	0.36	0.32
Sr	94.31	0.17	0.14	89.81	0.18	0.10
Se	27.99	0.74	0.80	28.07	0.76	0.76
Co	1.84	0.00	0.00	1.72	0.00	0.00
Cr	7.32	0.05	0.03	6.98	0.05	0.05
Cu	5.17	1.12	0.31	28.32	0.67	0.20
Mn	7.30	1.53	4.51	5.34	0.53	3.33
Mo	1.99	0.00	0.00	21.24	0.00	0.00
Ni	1.56	0.00	0.00	1.67	0.00	0.00
As	7.55	3.59	3.82	4.96	3.44	3.81
Cd	0.51	0.00	0.00	0.59	0.00	0.00
Pb	25.42	1.12	0.87	42.37	0.85	0.76
Si	7.78	37.62	109.79	0.00	39.81	97.39
Sn	5.29	0.00	0.00	5.44	0.00	0.00
Ba	31.58	2.47	2.56	11.09	2.10	1.47

1 3=Well Preserved Femur; 2=Fair Preservation - cortical erosion & darkening observed; 1=Poor Preservation - fragmented, high moisture, darkened, crumbly.

2 Ca/P is a measure of bone maturity: Ca/P @ 1.67 = mature, Ca/P < 1.67 = degree of maturity.

3 Soil in = soil sample approx. 2r cm adjacent to femur section used for analyses; soil out = soil outside burial pit.

4 Concentration in ppm except for bone Ca & P, which are in %.

Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #	7			8		
Sex	Male			Male		
Age approx. yrs	63			73		
Race	White			White		
Mastoiditis	0			1		
Bone Quality[1]	2			2		
Molar Ca/P Ratio[2]	1.55			1.55		
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.30	4.20	--	4.10	4.00
Elemental Composition[4]						
Al	421.82	565.56	492.56	84.26	471.36	384.60
Ca	34.52[4]	489.70	65.05	30.12[4]	502.80	46.63
Fe	294.85	118.40	38.04	108.29	113.90	30.77
K	33.79	5.39	2.08	6.24	2.94	0.76
Mg	1001.91	10.74	4.82	1284.65	6.67	3.42
Na	3703.36	70.43	72.75	3660.40	126.41	65.27
P	16.69[4]	193.80	20.39	14.61[4]	260.50	20.44
Zn	269.75	2.53	0.24	182.76	0.55	0.11
Sr	76.85	0.50	0.15	138.42	0.61	0.11
Se	28.59	1.25	0.76	28.66	1.12	0.69
Co	2.06	0.00	0.00	1.96	0.00	0.00
Cr	7.08	0.05	0.08	7.50	0.07	0.08
Cu	2.72	0.36	0.00	3.66	0.53	0.23
Mn	11.48	1.53	4.06	8.23	4.05	2.03
Mo	2.04	0.00	0.00	1.83	0.00	0.00
Ni	1.53	0.00	0.00	1.52	0.00	0.00
As	9.40	6.01	5.11	11.54	4.85	4.21
Cd	0.52	0.00	0.00	0.57	0.00	0.00
Pb	27.48	1.60	1.18	36.19	1.50	0.92
Si	4.09	18.73	114.09	0.00	46.88	93.99
Sn	10.53	0.00	0.00	5.70	0.00	0.01
Ba	26.16	5.29	2.80	15.78	5.60	6.11

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4 Concentration in ppm except for bone Ca & P, which are in %.

Ethnographical, Pathological, Bone Quality and
Soil & Bone Elemental Composition of Persons Exhumed
from Mt. Gilead Cemetery

Burial #	10			12		
Sex	UK			UK		
Age approx. yrs	2			2.5		
Race	White			White		
Mastoiditis	0			0		
Bone Quality[1]	1			1		
Molar Ca/P Ratio[2]	1.52			1.52		
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.40	4.20	--	4.60	4.10
Elemental Composition[4]						
Al	586.00	442.66	429.16	614.87	524.78	477.96
Ca	27.68[4]	241.40	68.23	26.99[4]	154.10	57.66
Fe	477.20	138.10	35.22	440.89	138.60	35.18
K	82.35	3.40	3.40	68.00	2.62	3.56
Mg	669.26	5.41	5.41	675.32	7.24	5.99
Na	2620.95	56.95	66.83	2657.16	89.01	60.71
P	13.56[4]	144.50	14.12	13.31[4]	140.60	6.87
Zn	174.24	1.02	0.22	279.53	0.67	0.23
Sr	73.58	0.45	0.19	60.60	0.28	0.17
Se	28.50	1.03	0.86	28.88	0.99	0.96
Co	3.35	0.00	0.00	2.88	0.01	0.00
Cr	8.13	0.09	0.09	6.97	0.09	0.10
Cu	7.03	1.43	0.27	12.52	0.26	0.17
Mn	65.16	1.71	3.19	160.73	1.88	0.53
Mo	2.07	0.00	0.00	2.08	0.00	0.00
Ni	3.10	0.00	0.00	3.61	0.00	0.00
As	11.55	4.92	4.66	12.04	5.43	4.94
Cd	2.37	0.00	0.00	1.00	0.00	0.00
Pb	28.53	1.31	1.23	22.91	1.17	1.14
Si	82.87	57.00	106.70	84.77	72.43	112.49
Sn	27.40	0.01	0.00	6.40	0.00	0.00
Ba	58.37	6.11	2.88	22.42	3.87	3.36

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4 Concentration in ppm except for bone Ca & P, which are in %.

Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #	13			14		
Sex	UK			Female		
Age approx. yrs	7			43		
Race	White			White		
Mastoiditis	1			0		
Bone Quality[1]	1			3		
Molar Ca/P Ratio[2]	1.54			1.53		
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.30	4.20	--	3.80	4.20
Elemental Composition[4]						
Al	624.11	454.46	431.16	538.00	375.26	63.46
Ca	29.54[4]	70.04	37.13	26.95[4]	37.63	148.70
Fe	408.36	79.85	35.68	423.71	34.27	149.20
K	38.58	2.87	2.26	0.10	0.00	1.28
Mg	963.06	5.12	4.31	1492.89	3.26	2.88
Na	2377.65	42.73	53.69	2935.26	62.55	41.41
P	14.41[4]	33.76	15.99	13.18[4]	10.20	142.90
Zn	142.11	0.27	0.20	197.49	0.14	0.47
Sr	73.30	0.12	0.79	130.66	0.09	0.20
Se	30.11	1.35	0.86	29.45	0.82	1.16
Co	2.73	0.00	0.05	3.45	0.00	0.07
Cr	7.65	0.11	0.10	6.88	0.06	0.21
Cu	2.44	0.11	0.19	4.01	0.17	0.07
Mn	47.96	1.46	5.92	17.76	5.48	3.94
Mo	2.00	0.00	0.00	1.84	0.00	0.00
Ni	2.14	0.00	0.00	2.09	0.00	0.00
As	11.43	5.05	4.82	10.47	3.88	7.11
Cd	0.60	0.00	0.00	0.57	0.00	0.00
Pb	29.97	1.28	1.15	31.54	0.89	1.90
Si	172.47	64.20	108.69	9.63	86.26	58.65
Sn	6.22	0.00	0.00	6.38	0.00	0.00
Ba	79.83	3.46	2.60	60.86	1.96	3.48

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4 Concentration in ppm except for bone Ca & P, which are in %.

Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #		16			17	
Sex		UK			Female	
Age approx. yrs		7			?Adult???	
Race		White			White	
Mastoiditis		0			0	
Bone Quality[1]		1			1	
Molar Ca/P Ratio[2]		1.52			1.55	
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.40	4.20	--	4.80	4.10
Elemental Composition[4]						
Al	3229.60	495.36	431.76	198.96	453.96	411.66
Ca	32.17[4]	45.76	428.30	32.70[4]	133.60	48.76
Fe	566.04	37.29	56.98	107.37	92.59	34.35
K	42.94	2.09	3.83	84.14	4.45	0.54
Mg	735.96	4.33	5.17	700.63	4.33	3.62
Na	2962.90	44.23	60.27	2585.78	63.22	51.22
P	15.89[4]	18.79	177.70	15.81[4]	49.24	10.88
Zn	159.05	0.19	12.56	533.74	0.28	0.60
Sr	112.42	0.12	0.38	92.98	0.31	0.12
Se	35.52	0.90	1.03	30.91	2.27	0.99
Co	3.36	0.01	0.23	2.47	0.01	0.01
Cr	12.25	0.09	0.09	7.25	0.83	0.11
Cu	3.87	0.23	3.00	5.48	0.13	2.26
Mn	57.35	6.32	3.09	7.17	2.79	4.09
Mo	3.76	0.00	0.00	2.12	0.00	0.00
Ni	3.42	0.00	0.00	2.51	0.00	0.00
As	45.66	5.68	4.62	7.14	4.91	4.42
Cd	0.63	0.00	0.00	0.61	0.00	0.00
Pb	39.88	1.27	1.48	32.30	1.22	1.10
Si	27.80	113.69	30.84	42.34	23.63	99.09
Sn	8.83	0.00	0.00	6.01	0.00	0.00
Ba	42.82	2.60	2.64	16.66	4.71	1.78

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4 Concentration in ppm except for <u>bone</u> <u>Ca</u> & <u>P</u>, which are in %.

Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #	19			21		
Sex	UK			Male		
Age approx. yrs	0.5			30		
Race	White			White		
Mastoiditis	0			1		
Bone Quality[1]	1			3		
Molar Ca/P Ratio[2]	1.53			1.54		
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out	Bone	Soil In	Soil Out
pH	--	4.30	4.20	--	4.00	4.20
Elemental Composition[4]						
Al	1308.19	467.26	513.46	386.90	466.66	488.76
Ca	27.70[4]	109.40	38.87	29.57[4]	47.56	47.14
Fe	725.06	100.00	40.99	341.35	34.09	38.40
K	46.90	2.58	1.03	0.00	0.42	1.34
Mg	936.86	4.91	3.16	1262.98	3.93	5.13
Na	2964.20	47.95	61.08	3413.86	55.13	50.73
P	13.53[4]	87.47	6.42	14.37[4]	10.16	14.33
Zn	323.29	0.55	.015	190.92	0.23	0.27
Sr	61.68	0.26	0.09	111.49	0.22	0.13
Se	30.19	0.93	1.00	28.98	0.95	1.00
Co	2.98	0.03	0.00	4.45	0.00	0.00
Cr	7.44	0.11	0.11	6.70	0.08	0.11
Cu	4.33	0.20	0.17	159.07	1.80	0.24
Mn	315.76	7.15	4.64	16.67	0.06	4.34
Mo	2.40	0.00	0.00	1.82	0.00	0.00
Ni	4.88	0.00	0.00	2.30	0.00	0.00
As	20.33	5.02	5.41	9.11	5.01	5.12
Cd	0.56	0.00	0.00	0.82	0.00	0.00
Pb	22.26	3.13	1.35	38.72	1.33	1.30
Si	188.59	34.47	64.43	36.28	109.69	18.89
Sn	16.22	0.00	0.09	6.10	0.00	0.00
Ba	142.61	9.50	1.86	45.93	2.01	2.04

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Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #	23			25		
Sex	Male			UK		
Age approx. yrs	65			5		
Race	White			White		
Mastoiditis	0			0		
Bone Quality[1]	3			1		
Molar Ca/P Ratio[2]	1.53			1.53		
Bone & Soil Data	**Bone**	**Soil[3] In**	**Soil[3] Out**	**Bone**	**Soil In**	**Soil Out**
pH	--	--	--	--	3.90	4.10
Elemental Composition[4]						
Al	207.40	--	--	1359.22	447.56	425.86
Ca	29.38[4]	--	--	28.02[4]	49.84	43.05
Fe	176.19	--	--	724.76	67.10	34.99
K	0.00	--	--	35.09	1.06	0.40
Mg	2525.68	--	--	753.79	3.58	2.87
Na	4754.15	--	--	2786.95	59.38	66.88
P	13.96[4]	--	--	13.71[4]	8.88	11.69
Zn	187.79	--	--	272.76	0.28	0.20
Sr	70.25	--	--	181.90	0.13	0.10
Se	29.29	--	--	31.05	0.90	1.15
Co	2.87	--	--	10.85	0.00	0.00
Cr	8.17	--	--	7.64	0.09	0.07
Cu	3.76	--	--	3.50	0.56	0.23
Mn	7.17	--	--	185.99	1.04	5.04
Mo	1.70	--	--	2.45	0.00	0.00
Ni	2.12	--	--	6.53	0.00	0.00
As	7.58	--	--	20.54	4.76	4.37
Cd	0.53	--	--	0.70	0.00	0.00
Pb	27.91	--	--	28.85	1.12	1.09
Si	14.24	--	--	107.33	72.74	104.50
Sn	6.13	--	--	6.51	0.00	0.00
Ba	16.39	--	--	125.07	2.52	2.29

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Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #	29			30		
Sex	UK			UK		
Age approx. yrs	5			11		
Race	White			White		
Mastoiditis	1			0		
Bone Quality[1]	1			1		
Molar Ca/P Ratio[2]	1.52			1.55		
Bone & Soil Data	**Bone**	**Soil[3] In**	**Soil[3] Out**	**Bone**	**Soil In**	**Soil Out**
pH	--	5.50	4.00	--	5.20	4.10
Elemental Composition[4]						
Al	512.79	527.86	503.76	355.26	409.36	406.76
Ca	15.55[4]	869.40	55.18	29.40[4]	370.20	46.08
Fe	259.92	150.90	39.79	201.75	105.80	37.89
K	14.64	3.04	4.50	60.00	4.65	0.67
Mg	397.28	7.06	3.63	646.39	6.78	3.51
Na	1441.52	66.98	49.26	2243.29	60.42	69.49
P	7.66[4]	503.70	16.51	14.20	190.40	17.51
Zn	204.00	2.13	0.19	217.35	0.85	0.97
Sr	55.64	0.79	0.12	83.56	0.32	0.10
Se	16.31	1.37	1.00	27.33	1.41	0.79
Co	2.22	0.06	0.04	2.27	0.00	0.00
Cr	3.98	0.14	0.14	6.72	0.13	0.09
Cu	1.68	0.34	0.14	2.55	0.12	0.21
Mn	87.24	5.22	7.37	9.51	0.49	4.66
Mo	1.28	0.00	0.00	1.86	0.00	0.00
Ni	1.94	0.00	0.00	1.77	0.00	0.00
As	8.57	5.74	5.73	8.50	4.47	4.23
Cd	0.31	0.00	0.00	0.61	0.00	0.00
Pb	22.08	19.49	1.58	35.36	1.34	0.97
Si	86.29	41.13	110.59	125.97	43.15	100.00
Sn	3.50	0.00	0.00	5.73	0.00	0.00
Ba	19.80	6.06	2.66	25.30	3.78	2.13

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4 Concentration in ppm except for bone Ca & P, which are in %.

Ethnographical, Pathological, Bone Quality and Soil & Bone Elemental Composition of Persons Exhumed from Mt. Gilead Cemetery

Burial #		31	
Sex		Female	
Age approx. yrs		68	
Race		White	
Mastoiditis		1	
Bone Quality[1]		2	
Molar Ca/P Ratio[2]		1.54	
Bone & Soil Data	Bone	Soil[3] In	Soil[3] Out
pH	--	4.30	3.90
Elemental Composition[4]			
Al	715.57	446.76	413.78
Ca	22.37[4]	127.60	52.38
Fe	488.60	70.43	34.09
K	50.03	4.12	1.74
Mg	566.40	5.34	5.10
Na	2071.54	68.59	59.82
P	10.87[4]	85.52	10.04
Zn	347.27	1.82	0.63
Sr	86.76	0.18	0.13
Se	27.05	1.10	0.81
Co	1.90	0.00	0.00
Cr	7.19	0.13	0.11
Cu	6.53	0.31	0.27
Mn	14.90	3.11	2.40
Mo	1.99	0.00	0.00
Ni	2.09	0.00	0.00
As	12.13	4.81	4.60
Cd	0.57	0.00	0.00
Pb	24.29	1.99	1.27
Si	204.74	38.30	105.89
Sn	5.56	0.00	0.00
Ba	20.96	3.24	1.53

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4 Concentration in ppm except for <u>bone</u> <u>Ca</u> <u>&</u> <u>P</u>, which are in %.

END

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